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ZI-KA-WEI OBSERVATORY ATLAS

OF THE
TRACKS OF 620 TYPHOONS
1893 — 1918

BY

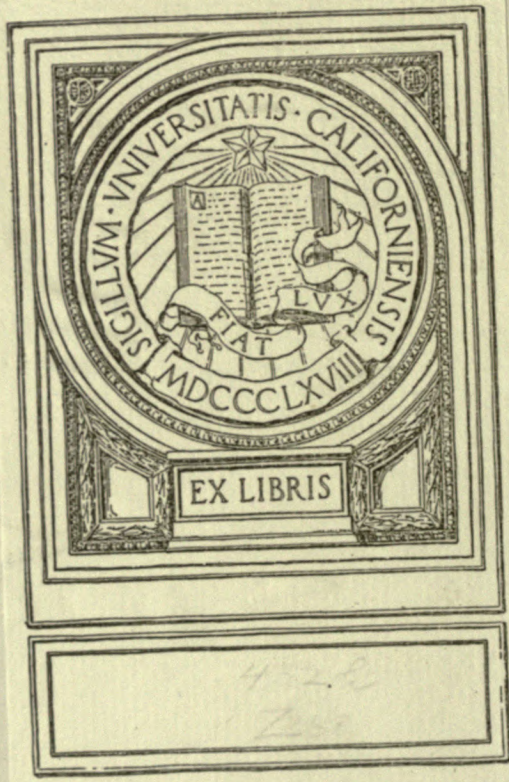
LOUIS FROC S. J.

DIRECTOR, ZI-KA-WEI OBSERVATORY

IMPRIMERIE DE L'ORPHELINAT DE T'OU-SÈ-WÈ

ZI-KA-WEI — CHANG-HAI

1920



UNIVERSITY OF
CALIFORNIA

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ATLAS

A CALL TO THE COOPERATION OF THE SAILORS.

It is obvious that the study of the Typhoons, and other kinds of storms, cannot be grounded on mere theoretical views imagined in the peaceful rest of a study-room. It must rely on facts, and many particulars, that appear indifferent in themselves, may have a great bearing on the explanation of rules of capital importance to those who live a great part of their existence at Sea. But these can be gathered only from reports taken during the struggle with real and practical storms: the evidence must be sifted among many cases before finding the full light required in such matters.

Many Captains, during a long series of years, have had the great kindness of giving us that necessary help, and we beg to thank them most heartily. At the same time we avail ourselves of the occasion to suggest that any report sent from the ships during their sailing between Singapore and Japan are always interesting, and often very important, even when no bad weather has been experienced on board. Those who would kindly follow the lead of our old cooperators could find printed forms for that purpose at the Semaphore Station, on the Bund, close to the Time-Ball tower. When these forms are filled, it is not necessary to send them by post, but you have only to send a sailor to bring them to the same Time-Ball station, when the ship arrives at Shanghai. That will be a profit, not only for the observatory, but for those to whom we shall thus be able to give better information in the future.

a more general and detailed study on the risk of considerable delay, owing to many of those the more interested in the matter, a few notes that seem indispensable for the

use to go on with the publication. Last year the dangerous reefs of the Paracels. One ship escaped only with considerable damage. The Captain and staff, making good for Hong-Kong, that he was misled by the extraordinary facts was contrary to all the laws of typhoons. Explanation of the tropical storms.

Without waiting any more, with a complete refrain here from entering into the field of study will be found, chiefly on the China Sea, exceptional, but the number of instances pre-against the possibility of such a course of cyclone which came from the Pacific, on with Turnabout, and recurving towards were some steamers at the time in the Strait, and the ships: of course the fact must be

Whatever may be the grammatical explanation, or cyclones of oceanic origin, born more towards the asiatic coasts, or towards the seas to Japan, the Kurile and Aleutian islands and squalls or Depressions, born on land and volcanic might quite well be classified with the

their whole existence, may well be but as they pass; their violence may also change into depressions, of a fairly mild behaviour, when they energy and develop into violent storms that San Francisco. In other cases, we have still the land, and took again to the sea to the North

of Shanghai. When they passed near by, the barometer was little affected, and a few heavy showers only marked the passage: it was necessary to keep a very close watch to believe oneself in the heart of a typhoon. It was not dead however, but only drowsy, and less than 12 hours afterwards, it was wide awake again, and having recovered, on its proper element, its old energy, it was stirring up the sea in mountainous waves, and shaking with a wind of force 11 to 12 the steamers on their way, across the Yellow Sea, between Korea and Shanghai.

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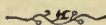
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ATLAS

OF THE TRACKS

OF 620 TYPHOONS IN THE FAR-EAST.

[1893—1918]



The first purpose of the author was to issue the following charts as an appendix to a more general and detailed study on the oceanic storms of the Far-East. But as the publication of such an essay will certainly run the risk of considerable delay, owing to many circumstances, it has been decided that the appendix should appear at once for the benefit of those the more interested in the matter, the Sailors. These charts constitute a whole that may stand by itself: we shall only add a few notes that seem indispensable for the clear understanding of the maps.

It is not out of the subject to know the occasion which practically gave the last impulse to go on with the publication. Last year (1919) two steamers were caught in a very violent typhoon, on the China Sea, not far from the dangerous reefs of the Paracels. One of them became a total loss, and went down to the bottom with every one on board; the other escaped only with considerable damage and got out of the terrible struggle and agony by the bravery and seamanlike qualities of her Captain and staff, making good for Hong-kong with her last ton of coal burning. In his thrilling report the Captain makes this statement: that he was misled by the extraordinary motion of the storm towards WSW, a thing he could not guess to have happened, because it was contrary to all the laws of typhoons. And he thought the captain of the ship that was lost had been misguided by the same conception of the tropical storms.

The above lead us to believe that it was very important to supply the shipmasters without waiting any more, with a complete collection of the tracks, before the opening of the new typhoon season. Although we must refrain here from entering into the field reserved to the theory, we shall only point out that, by a glance at the charts, several tracks will be found, chiefly on the China Sea, which follow the direction mentioned: the occurrence is rare, of course, it may be termed exceptional, but the number of instances prevents from saying that it is against the laws of storms, and every one must be on his guards against the possibility of such a course followed by the centres of the typhoons. — A far more singular example is that of the violent cyclone which came from the Pacific, on the 1st of September 1910, passed about 60 miles to the N of Formosa, came in close contact with Turnabout, and recurving towards SW, followed the coast, to land between Good Hope and Swatow. By a good chance, there were some steamers at the time in the Strait, and we were enabled to follow the centre that passed, all through, between the lighthouses and the ships: of course the fact must be very rare, but not impossible, as shown by experience.

The meaning of "TYPHOON."

We must at first make clear the exact meaning we give here to the term *Typhoon*. Whatever may be the grammatical explanation of the word, it must be understood that we adopt that name to signify all the depressions, or cyclones of oceanic origin, born more generally under the tropics, but not always so far, which as a rule advance from the open sea, towards the asiatic coasts, or towards the long line of islands developed in a large arc, roughly circular, from Borneo and the Philippines to Japan, the Kurile and Aleutian islands and Kamchatka. It is a class of phenomena entirely distinct from the group of the continental squalls or Depressions, born on land and progressing, in an opposite way, towards the Ocean. The dreaded cyclones of the Bay of Bengal might quite well be classified with the Typhoons.

The energy of these disturbances may be extremely variable. Some of them, during their whole existence, may well be but moderate depressions; others are destructive hurricanes, sweeping and upsetting everything as they pass; their violence may also change greatly, increase or decrease during the life of one and same typhoon. Thus some tropical depressions, of a fairly mild behaviour, when S. of Japan, or across that archipelago, have been seen to increase gradually or suddenly in energy and develop into violent storms that endanger the big mail steamers crossing the Pacific, between Japan and Vancouver or San Francisco. In other cases, we have still the fresh remembrance of big typhoons, which after having landed near Foochow, recurved on land, and took again to the sea to the North of Shanghai. When they passed near by, the barometer was little affected, and a few heavy showers only marked the passage: it was necessary to keep a very close watch to believe oneself in the heart of a typhoon. It was not dead however, but only drowsy, and less than 12 hours afterwards, it was wide awake again, and having recovered, on its proper element, its old energy, it was stirring up the sea in mountainous waves, and shaking with a wind of force 11 to 12 the steamers on their way, across the Yellow Sea, between Korea and Shanghai.

Therefore, if on the one hand one must take care not to be frightened by the mess of tracks, crossing each other in a kind of confusion on our charts, and to conclude that a perpetual storm is raising incessantly the waves of the inhospitable seas of the Far-East, on the other hand one must be careful and keep an eye on the weather, as soon as the ship is crossing certain regions, during the months signalled by the charts as rich in typhoons. Remember as a rule that it is impossible to say in advance what you may find in the centre of an oceanic depression. It is sure that they are wont, generally speaking, to be more violent during the so called *season* of typhoons (June to end of October), but if a captain asks, before leaving, if that kind of depression is violent or not, it would be imprudent to answer : never mind. Perhaps the known conditions are reassuring to-day, but who can say what shall happen to-morrow ?

Disturbed areas.

The region to which the trouble caused by each typhoon extends itself has a considerably variable extent, if we consider two separate cases, and even during the same storm. The area or according to the term adopted, the diameter of the cyclone may not exceed 50, 30, or 25 miles in one instance, but the following one will cover 200, 300, and 500 miles and more. The subject will be properly put in light by two striking examples. — The big typhoon of August 1901, in which the Russian steamer "*De Witte*" was lost, in the open sea, to the N of Formosa, was raising at the same time strong winds, belonging to the same whirl, from W at Padaran, on the coast of Annam, and from E in the Kii Channel in Japan : the diameter was thus more than 1800 miles long. A few weeks afterwards, we received the circumstantial report of a ship that had been in a terrible hurricane, in the Hainan Strait, between that island and the coast of China. High seas had embarked on the upper deck, and the crests of the waves had risen higher than the funnel ; the report says that the sea was just like a boiling pot. It was interesting, to make the case clear, to ask information at the Kwanchowwan harbour, a few miles distant. The Commandant of the navy there answered that indeed a dark bank of clouds had been observed, on that day, far in the S horizon, but that otherwise no trouble, nothing at all had occurred, and the station was less than 75 miles of the centre.

However to give to the charts below their full meaning, the zone affected by the typhoons must not be limited to the thin lines representing the tracks, but each of these trajectories must be taken as the axis of a dangerous zone that must be drawn, as an average, some 100 or 200 miles on both sides of the track.

Since we are speaking of the *Diameter* of the typhoons, let us add an explanation to answer the wishes uttered by some captains about the signalling of that information at the semaphores, among the typhoon signals. I greatly sympathize with their desire, and my own mind is to supply them with all the particulars that would not make the code too complicated, and the arms of the semaphores loaded with too long a concatenation of symbols. But as far as the diameter is concerned, I must confess that the information would be so vague, so misleading, that in the immense majority, if not the totality, of cases, the symbol meaning "*unknown*" should be hoisted, and it is better to get rid of it at all. — When a typhoon has passed, and the documents are at hand, it very satisfactory, and fairly easy too, to determine the surface of the disturbed area, and even to divide it into zone A, zone B, and zone C.... all things very important to enable the reader to make for himself a theoretical idea of the revolving storms, about which the more you know, the best ready you are to meet them practically in the future. But when a living typhoon approaches, it is extremely difficult to say how broad it is, and chiefly to tell the Captains where the dangerous zone begins, or rather was beginning when the stations sent their reports, and still more where it will begin in 6 or 10 hours, when you see the signals duly hoisted at the semaphores. Most of the dangerous typhoons, as you may see in the charts, come from the broad Pacific, and as you know, in that immense space, measuring about 1200 miles in all directions, there is not a single island, a single station to observe and report, and we may add that very few steamers are to be found there, with wireless apparatus, for the course of navigation is much nearer the islands or the coast. Therefore, the necessary data are so scanty, that it would not be safe to give any degree of precision before the centres are in the approaches of the Philippines, Formosa and the Loochoos. When they are so near, you begin to feel them along the coast, and there is no need to give information. The best way is thus, we believe, to remember that the typhoons are, as a means, 100 or 200 miles broad, in their dangerous portion, and to take decisions according to that general knowledge.

How to read the Charts.

At first sight, we fear that the aspect of the lines crossing each other on the maps will appear rather tangled ; but we hope that thanks to the numbers repeated at both ends of each track, every captain will succeed to get out successfully of the labyrinth, and to follow one by one all the ways traced by the typhoons during the season and in the region in which he is actually sailing. The drawing should have been more clear, and less laborious too, had we reduced the work to certain mean directions, by collecting in one average trajectory the tracks of some 10 or 15 typhoons. That is true, and we are far from contesting the utility of the means ; but we must not lose sight of the fact that, in the practical life of every day, nautical or otherwise, we are always confronted with particular cases, and not with an average. Of course, it is not without profit to know, that when crossing the China Sea, during September, we are exposed to meet typhoons travelling along a general diagonal line from Bolinao to Hainan island ; but it is still more important to be informed of the wanderings of the storm centres on both sides of that mean line, and such information is provided by the publication of each individual case. We shall try to give, at the end, on a more reduced scale, the picture of the dangerous zones, month by month, by drawing more or less dense shades on the affected regions, but the lesson is not so striking than the sight of each track as it was ploughed individually by each typhoon during the 26 years considered. — With a view however to making more easy the reading of the charts, we have divided in three periods of ten days the months during which the number of cases would have caused inextricable confusion.

I need not say however that, while it was materially practicable to draw all the trajectories without exception, it has been found physically impossible to reproduce all the windings of small amplitude wrung by the centres on both sides of their tracks. This is feasible in a study, a monography, of each storm, where every particular can be dealt with at length. Here, the large recurving motions are drawn when they occurred, but there are some backwards movements, some secondary inflexions or "loops" that would have made the maps illegible, and would not have been of any avail for the purpose of the Atlas. To make it, we have taken, in the Bulletins of the Zikawei Observatory, the points where the storms were noticed at first, and the terminus to which it was possible to follow them, together with the places where they landed or recurved, and the tracks were thus determined, as exactly as the matter permitted; the steering of a typhoon is not the same as that of a steamer. But all the exceptions to the ordinary behaviour of the tropical storms are embodied in the present Atlas, as far as the 26 years are concerned; and here we may draw the attention of the reader on this remark, that there was a great advantage to publish every track and not the mean tracks only: the irregularities disappear as a rule in the means, and with them not a few dangers against which it was necessary to put the Captains on their guards; for instance the WSW tracks of the China Sea would have passed unnoticed, immersed as they would have been in the overwhelming majority of typhoons running towards NW.

On the Classification of Typhoons.

Many attempts have been tried, by distinguished authors, to divide the typhoons into classes, and the grouping of storms in certain categories has a technical interest, the utility of which we have no intention to deny. But here our view is quite a practical one; the present work aims only at the nautical guidance of the Sailor. Now it is less important to him to know that the typhoon belongs to such or such a group, of the class A, B or C, than to be informed that, at the actual portion of the year, and on the sea where he is sailing, the storm follows this or that direction, whatever be its origin, and whatever be the regions it has visited previously, and many other things that it is difficult to determine on the spot, when a Captain at sea knows only that he is faced with a real typhoon. We have thus followed the order of the natural happenings, as they took place, by enumerating the cases, in the same way they have presented themselves, one by one, month by month. Some months are less rich in storms, and one chart was enough for each of them: December, January, February, March, April, May and June; November has two charts, one for each half of the month; the other months, those of the true typhoons season, are divided in three decades: July, August, September and October.

Rate of progression on the tracks.

An element that it is essential for the reader to know, but that could not be made conspicuous on the maps, is the speed or *velocity* of the centres on their respective trajectories. In a general essay on the typhoons that particular may be given for each individual case: here that was impossible for obvious reasons. We are thus compelled to content ourselves with means; and as that characteristic advance of the storms is in close relation with the geographical place where they are travelling, we shall divide the Far-Eastern Seas into six sections and collect in tables the information corresponding to each region.

Section 1: China Sea and coast to the S of Hainan Island.

Section 2: North China Sea and coast, up to Swatow.

Section 3: Approaches of Formosa, and coast up to Hieshan.

Section 4: Eastern and Yellow Seas and coast from Hieshan to Korea.

Section 5: Pacific and southern coast of Japan.

Section 6: Pacific far from all coasts with the Bonin about the centre.

In a first table will be found, for each month and each section the mean speed towards two directions, when they exist, viz. NW and NE. Here we understand by NW and NE, not a precise direction, but a general motion, the idea of which is impressed by a glance at the maps. The scale is in nautical miles per hour.

TABLE I. — Mean Speed.

Months.	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.		Section 6.	
	NW	NE	NW	NE	NW	NE	NW	NE	NW	NE	NW	NE
January	11,0	×	×	×	×	×	×	×	×	23,4	×	18,8
February	9,0	×	×	×	×	×	×	×	13,3	16,0	×	21,6
March	6,0	×	×	×	×	×	×	×	10,0	21,5	11,0	21,6
April	9,7	×	×	×	×	×	×	×	7,5	20,7	13,7	26,0
May	11,3	×	10,0	×	×	×	×	×	9,7	19,2	8,9	16,9
June	10,1	×	10,0	×	11,5	18,7	×	×	×	14,0	9,0	17,1
July	10,8	×	8,7	25,0	10,3	19,8	11,4	18,6	11,9	18,9	11,3	18,5
August	10,7	×	10,2	12,0	11,1	20,2	12,9	18,7	11,1	18,9	13,2	18,0
September	11,0	×	10,8	[40,0]	12,1	22,4	10,6	21,4	11,9	22,8	10,0	18,2
October	10,6	×	9,9	10,0	13,5	×	×	21,0	11,9	21,5	12,5	17,0
November	10,1	×	8,0	8,0	×	×	×	×	16,3	22,6	8,2	16,8
December	11,8	×	12,0	×	×	×	×	×	11,0	25,0	12,0	19,7
Mean	10,2	×	10,1	19,0	11,7	20,3	11,6	19,9	11,5	20,4	11,0	19,2

The second table contains an information very important to know; it is the extreme velocity or highest speed observed, during the period of 26 years, in the same six districts as before. The absolute maximum, 52 nautical miles (96 kilometers) is extremely rare, but has been determined with great accuracy, thanks to self-registering instruments on board steamers at anchor in harbours of the S coast of Japan. We make the same distinction as above between the speed towards NW and towards NE.

TABLE II. — Extreme Speed.

Month.	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.		Section 6.	
	NW	NE	NW	NE	NW	NE	NW	NE	NW	NE	NW	NE
January	14	x	x	x	x	x	x	x	x	30	x	31
February	9	x	x	x	x	x	x	x	18	18	x	40
March	6	x	x	x	x	x	x	x	x	30	11	30
April	12	x	x	x	x	x	x	x	8	28	10	43
May	16	x	10	x	x	x	x	x	13	25	16	28
June	15	x	12	x	16	23	x	x	x	14	10	32
July	14	x	13	x	12	23	15	26	16	25	15	28
August	14	x	16	12	22	26	20	27	21	40	17	25
September	17	x	18	x	17	34	16	25	20	52	15	38
October	16	x	12	10	15	x	x	21	20	39	20	25
November	16	x	8	8	x	x	x	x	15	40	11	25
December	16	x	12	x	x	x	x	x	12	38	12	28

Lastly it will be interesting to find here the approximate positions of the points where the tracks mostly recurve, or the places of the summits (apices) of the *parabolas*. For this table we shall limit ourselves to the months of the typhoon season proper, because the data are too scanty, during the other months, for the four first sections. The last line however gives the means for the whole year. Needless to say that the following figures are mere averages, and that the maps are far more instructive to show between what limits the occurrence of the recurving motion may take place. The points are given by their latitudes and longitudes.

TABLE III. — Points of recurving of the tracks.

Mean	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.		Section 6.	
	Lat. N.	Long. E.	Lat. N.	Long. E.	Lat. N.	Long. E.	Lat. N.	Long. E.	Lat. N.	Long. E.	Lat. N.	Long. E.
June	15°	112°	x	x	16°	119°	x	x	37°	136°	22°	123°
July	21	107	21°	117°	27	121	29°	123°	29	127	25	126
August	x	x	22	118	27	119	29	123	27	129	24	132
September	20	119	24	116	26	118	33	123	26	127	24	134
October	16	120	18	120	x	x	x	x	24	128	23	134
Mean (year)	17	115	21	118	24	119	31	123	27	129	22	130

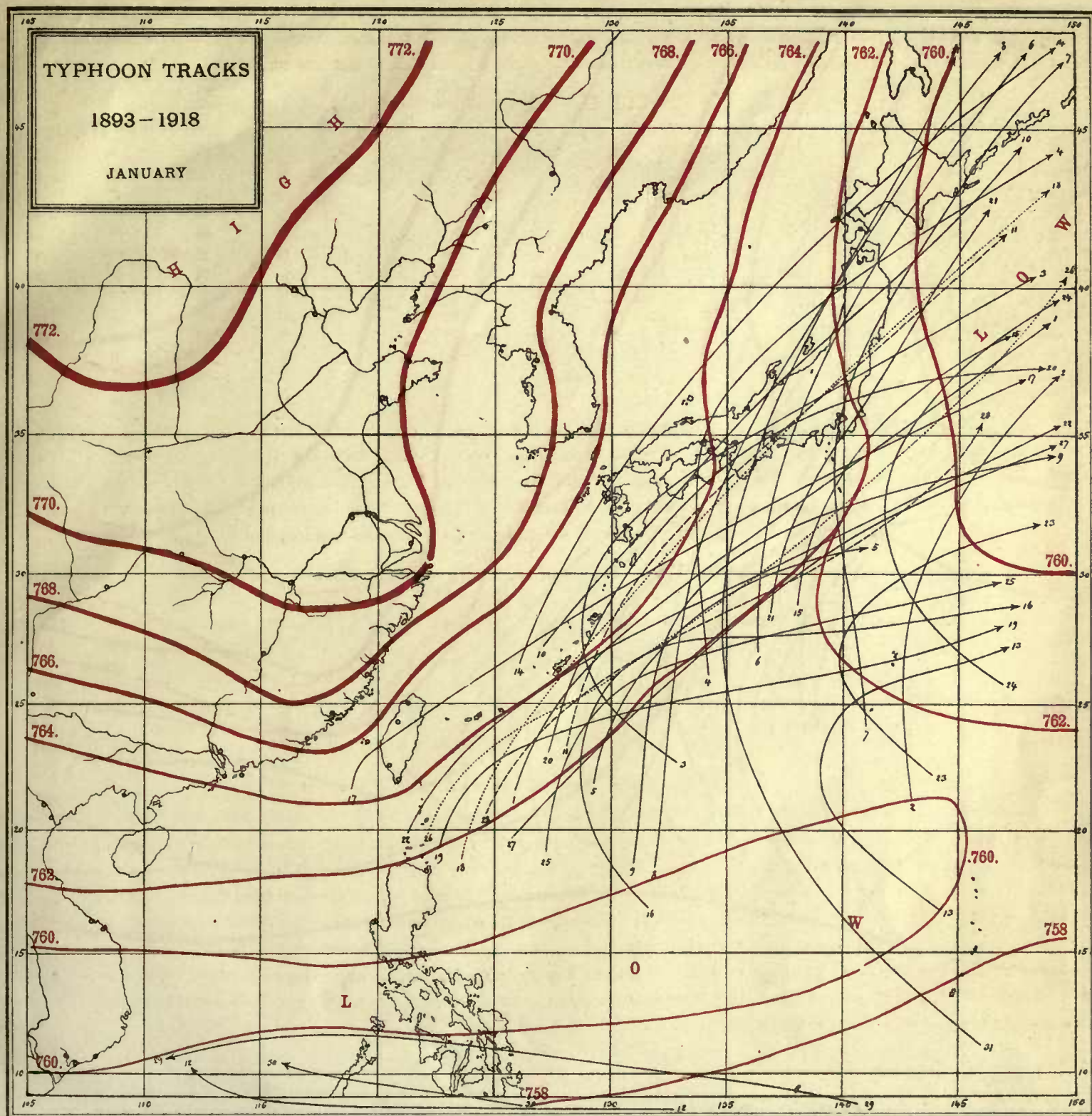
Well deserved thanks.

We beg to present this work to all those who, by their kind and constant cooperation, for many years now, have made possible and easy the study of so numerous storms, and chiefly to the sailors who very often in the midst of hard struggle with the elements, have found time to collect observations for the sake of those who would run the same risks after them. To establish each track of the maps, the Bulletins of the Observatory have made use of at least 10, sometimes 20 or more reports received from stations on land and ships at sea; and we are glad to show our benevolent cooperators, while offering them our hearty thanks, that the task spontaneously undertaken by them has not been without reaching a very important and useful aim. — The typhoon season of 1920 is just in sight: we hope that voluntary observers will continue to offer themselves to assist us in preparing a still more comprehensive study of those dreaded dangers of the Far-East. Lastly let us pay a grateful tribute to the memory of those of our brave friends who have disappeared from our midst: their number is great since the old days of 1879.

LOUIS FROC. S. J.

TYPHOONS IN THE FAR EAST DURING 26 YEARS.

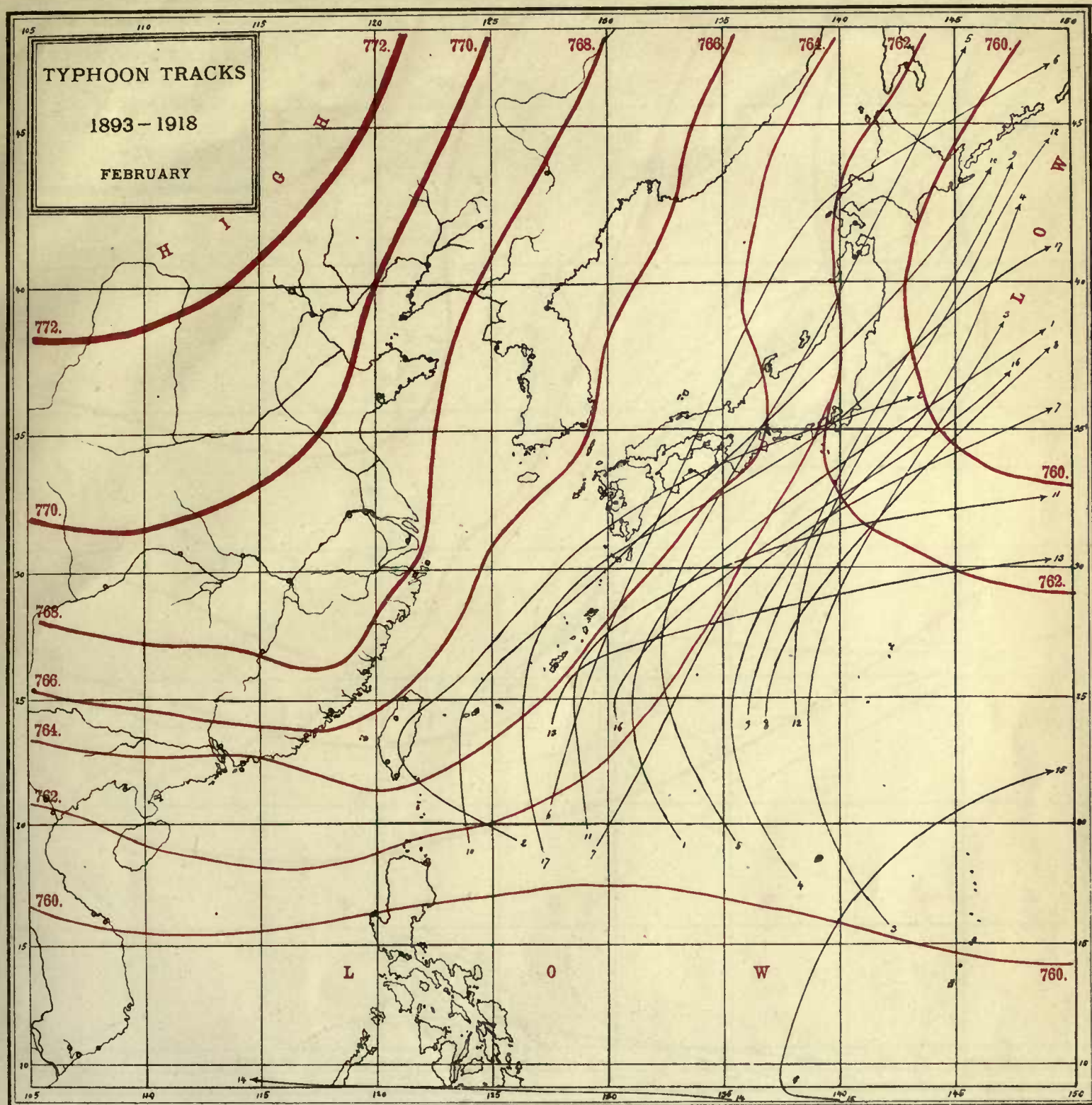
CHART I.



JANUARY. — Single chart : 31 tracks ; a little more than one every year.

Remarks. — A diagonal traced on the map, from Cape St. James to La Pérouse Strait, divides it in two halves ; the one perfectly free of storms, comprises the China Sea, the Eastern Sea and the Sea of Japan ; the other is the Pacific ploughed by the depressions. Four centres are seen on the edge of the Eastern Sea and near the W coast of Nippon, but they form a rare exception. The very few ones who venture off the W of Palawan, along the 10th parallel, are soon filled up before reaching the coast of the continent.

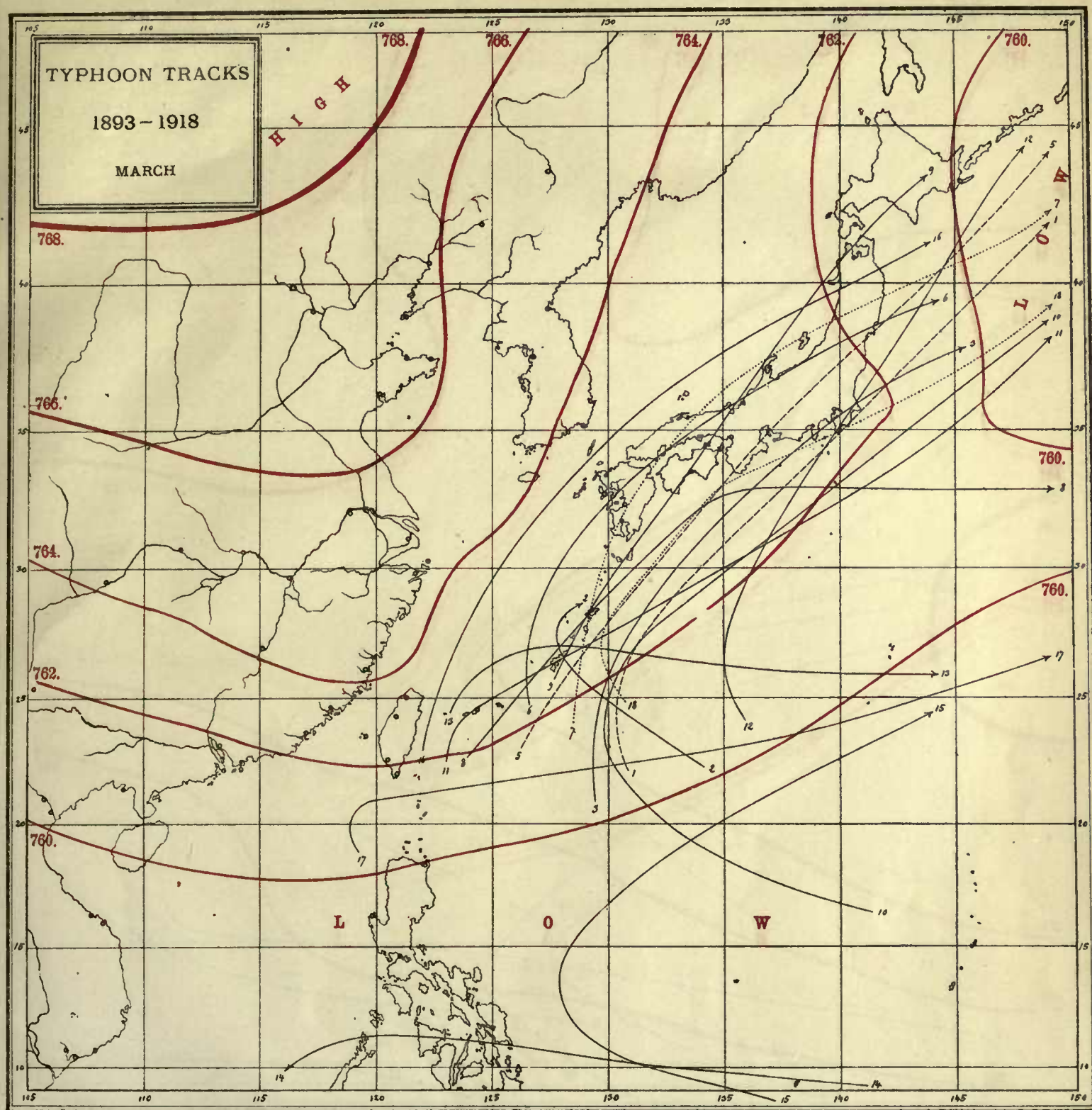
As regards their origin, there is a well marked focus between the Carolines and the Marianas, probably between lat. 5° and 8° east of the 140th meridian ; others take shape on the Pacific, off the N. of Luzon, but it is difficult to trace them up to the precise birth place. At first, they generally travel towards N or NW, recurve to NE between the 20th and the 25th parallels, the turning point is often found between the 130th meridian and Formosa. Most of the tracks are seen to pass between the Bonin group and Japan ; some cross Nippon making for the Sea of Okhotsk ; but the majority go away on the Pacific, where they frequently acquire a great violence, as shown by the reports of the ships sailing between the Far East and Vancouver or San Francisco.



FEBRUARY. — Single chart : 17 tracks ; a little more than two cases in three years.

Remarks. — The line dividing the map in two areas, the one calm, the other disturbed, has advanced some 8 or 10 degrees towards the East. The Philippines, Formosa and Kiusiu are practically out of the dangerous zone ; the Sea of Japan and the Eastern Sea have been visited, in their eastern border, only once or twice ; the Pacific, east of Luzon, is also remarkably free, as well as the China Sea where only one depression ventured a few miles W of Palawan.

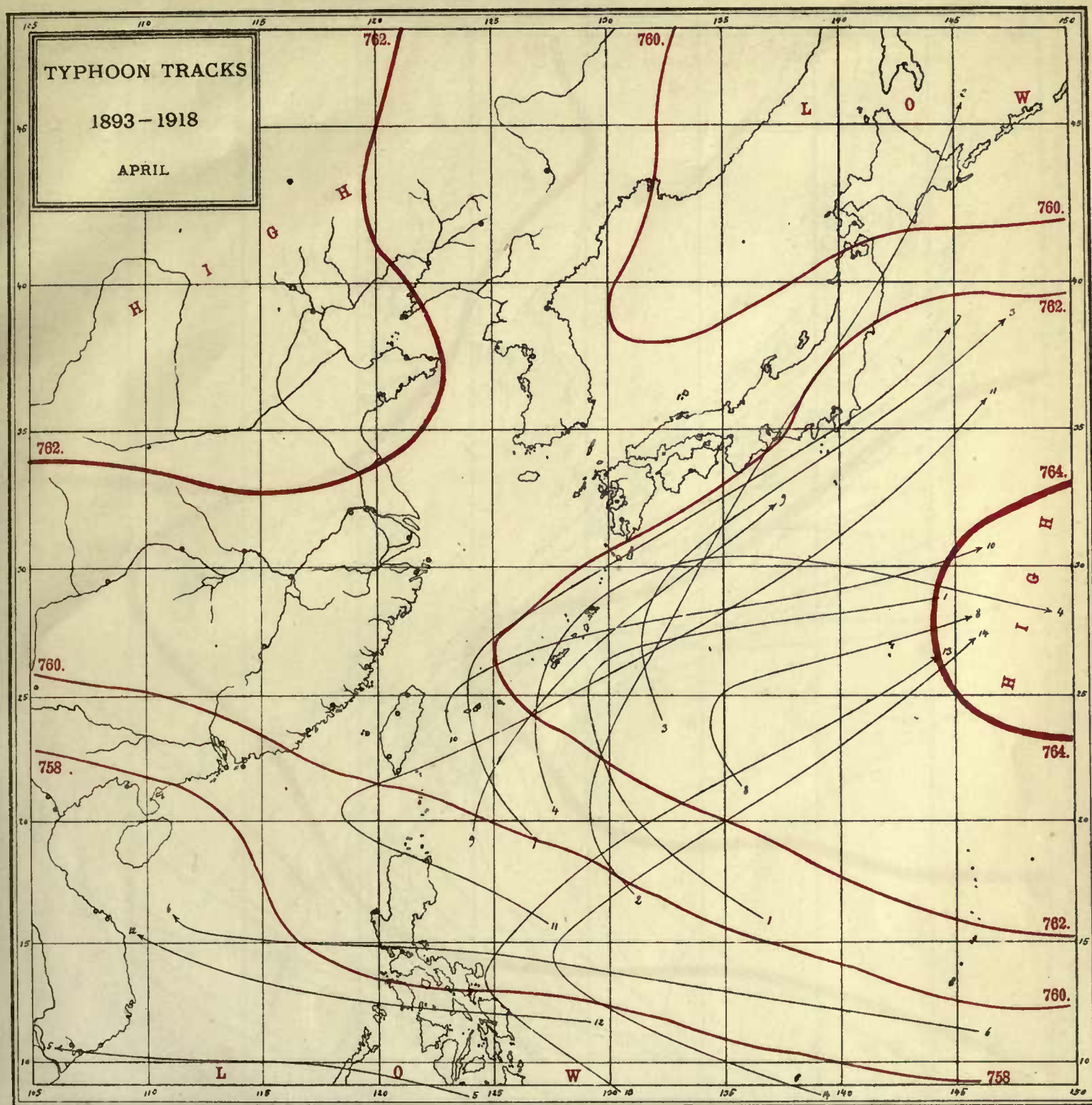
The centre of origin remains at the low latitudes, but is considerably less fertile ; many depressions are detected only after they have travelled a long distance, but their convergence continues to point to a spot between the Carolines and the Marianas. After having advanced towards N or NNW, all of them recurve at a higher latitude than last month, about the 25th parallel or between lat. 25° and 30°, off the eastern Loochoos. They are then seen to run towards the NE, and disappear on the Pacific, between the Bonin Is. and the Kuriles, with the same increase of strength and deepening of the central minimum as during the preceding month.



MARCH. — Single chart : 18 tracks ; a little more than two cases in three years.

Remarks. — The frequency of the occurrences is the same as during February, but there is a distinct change in the grouping of the tracks, which are more dispersed at their beginning, though they continue to come close together at the end. The focus still exists between the Carolines and the Marianas, but much weakened. There is a general advance of the recurving point towards the W, and it is not rare to find it now between Formosa and the Loochoos.

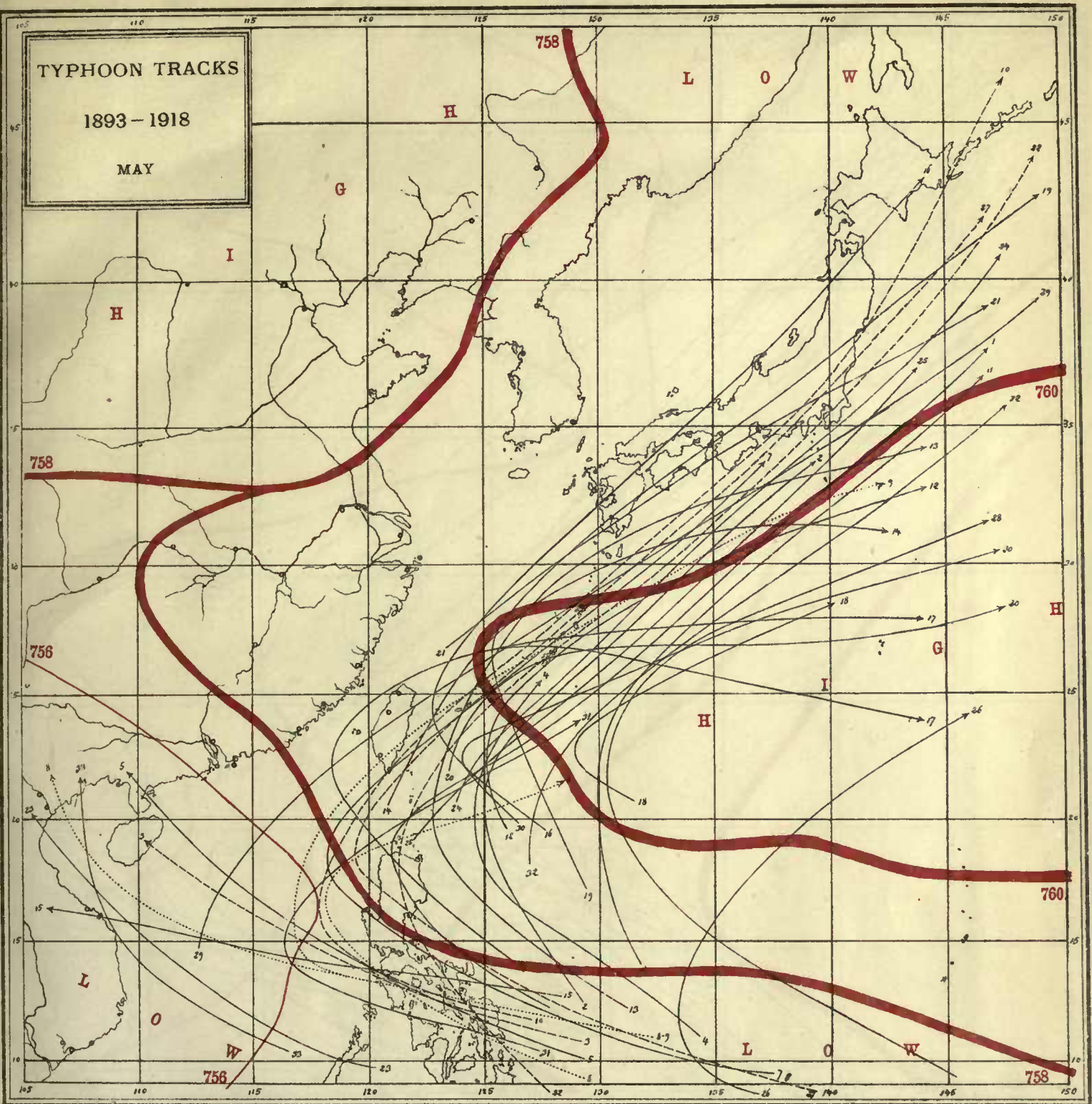
A few tracks sweep straight across the Bonin, but most of them are following higher latitudes to come close near the coast of Japan. One depression has advanced to the middle of the Eastern Sea, and across the SE part of the Sea of Japan ; another is shown in the straits between Formosa and Luzon. But it is still the epoch of calm for the China Sea and practically for the area situated to the NW of a line joining Formosa to Hokkaido. It must be noted that during the same period that part of the map is crossed by many continental depressions. It is well to remark that the advance of the tracks westward corresponds to a movement of the isobaric line 764^{mm} from Japan and the Loochoos to the W part of the Eastern Sea and Korea.



APRIL. — *Single chart : 14 tracks ; a little more than one case in two years.*

Remarks. — We are passing through the minimum of the disturbing activity ; however the focus shown in the low latitudes gives signs of increasing energy and begins to throw some centres of depressions across the Philippines, on the China Sea, where they persevere to the close neighbourhood of the coasts of Indo-China. One of them deserves a special notice : it was a narrow and violent typhoon which swept over Cape St. James and caused considerable destruction in the Saigon river on the 1st. of May 1904.

Very rare are the oceanic depressions that reach Japan, this month ; but on the contrary they show a tendency to converge more to the south towards the Bonin Is., to continue on the Pacific. The recurving points continue their movement of the preceding month westwards, in some instances they have approached the eastern coast of Luzon, and one track has recurved between the Bashi and Ballintang channels not far from the Pratas. This corresponds again with a new retreat of the high pressures on the continent : the isobar 762^{mm} has replaced on the chart, along our coasts, the line 764^{mm}, which has retired as far as Mongolia.

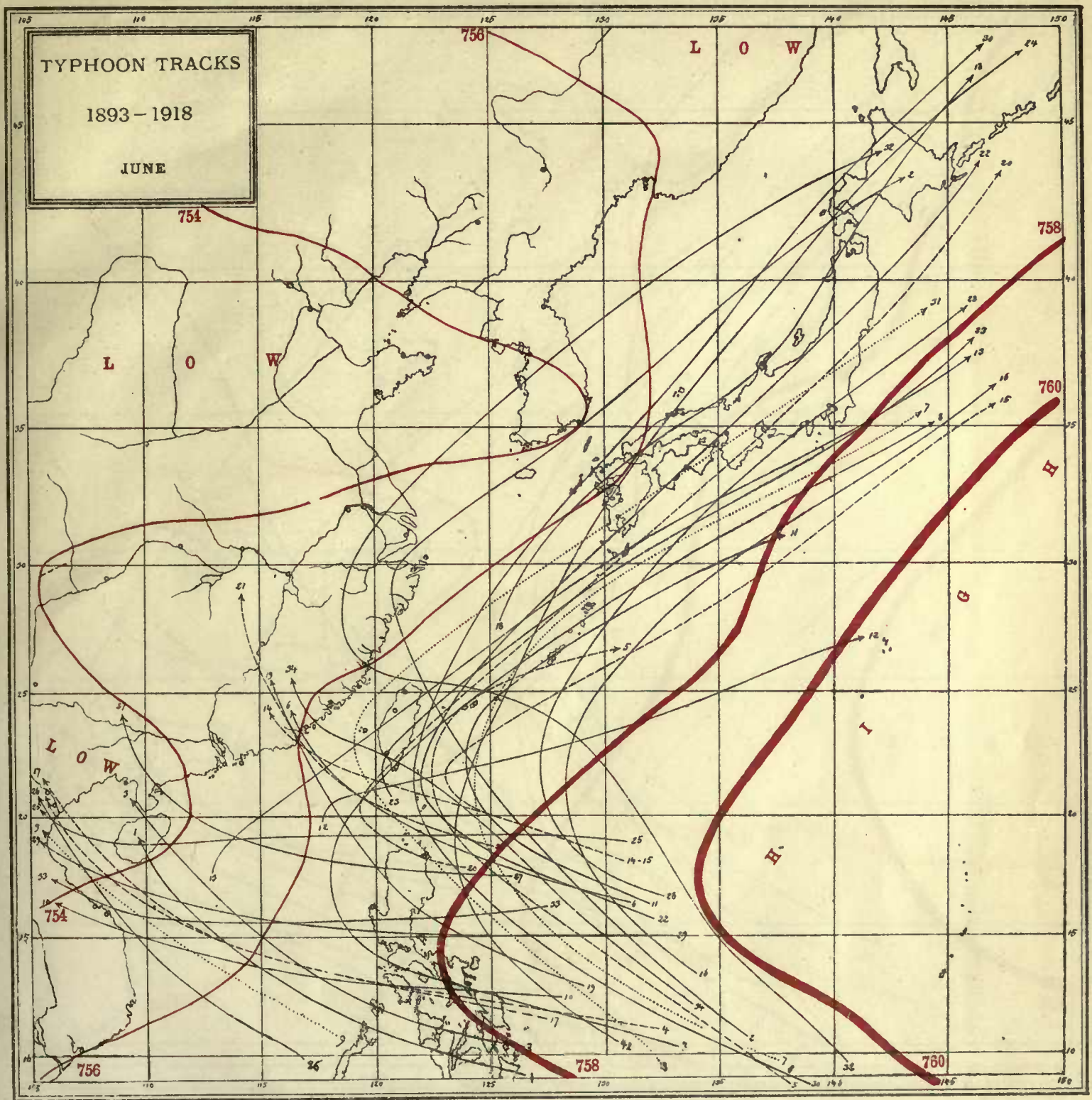


MAY. — Single chart : 33 tracks ; a little more than one case every year.

A very significant change has taken place: while the number of the perturbations has more than doubled, their trajectories make a considerable bound towards the W, where their wanderings become easier for the reason that the great continental maximum is weakened and has retired a long way towards Siberia. The tracks begin to invade the Philippines and even the China Sea and after recurving towards the NE, form a dense bundle between Formosa and the Loochoos.

Several curves are turning on the China Sea, off western Luzon, not far from the Maclesfield bank; others have their recurving apex to the S. of the Meiaco-Sima group. The Sea of Japan and the Eastern Sea are still relatively free of their incursions, but a characteristic feature of the month is the invasion of the China Sea: no less than 6 typhoons, increasing in violence, are seen to strike the coast between Tourane and Kwang-chow-wan, crossing sometimes the Gulf of Tongking.

The birth-place of the storms has gained ground northwards and chiefly westwards: if we look to the converging point of the prolonged tracks, we see that they are mostly issued from the occidental Carolines, in the region of Yap. It is the opening of the true typhoons season.

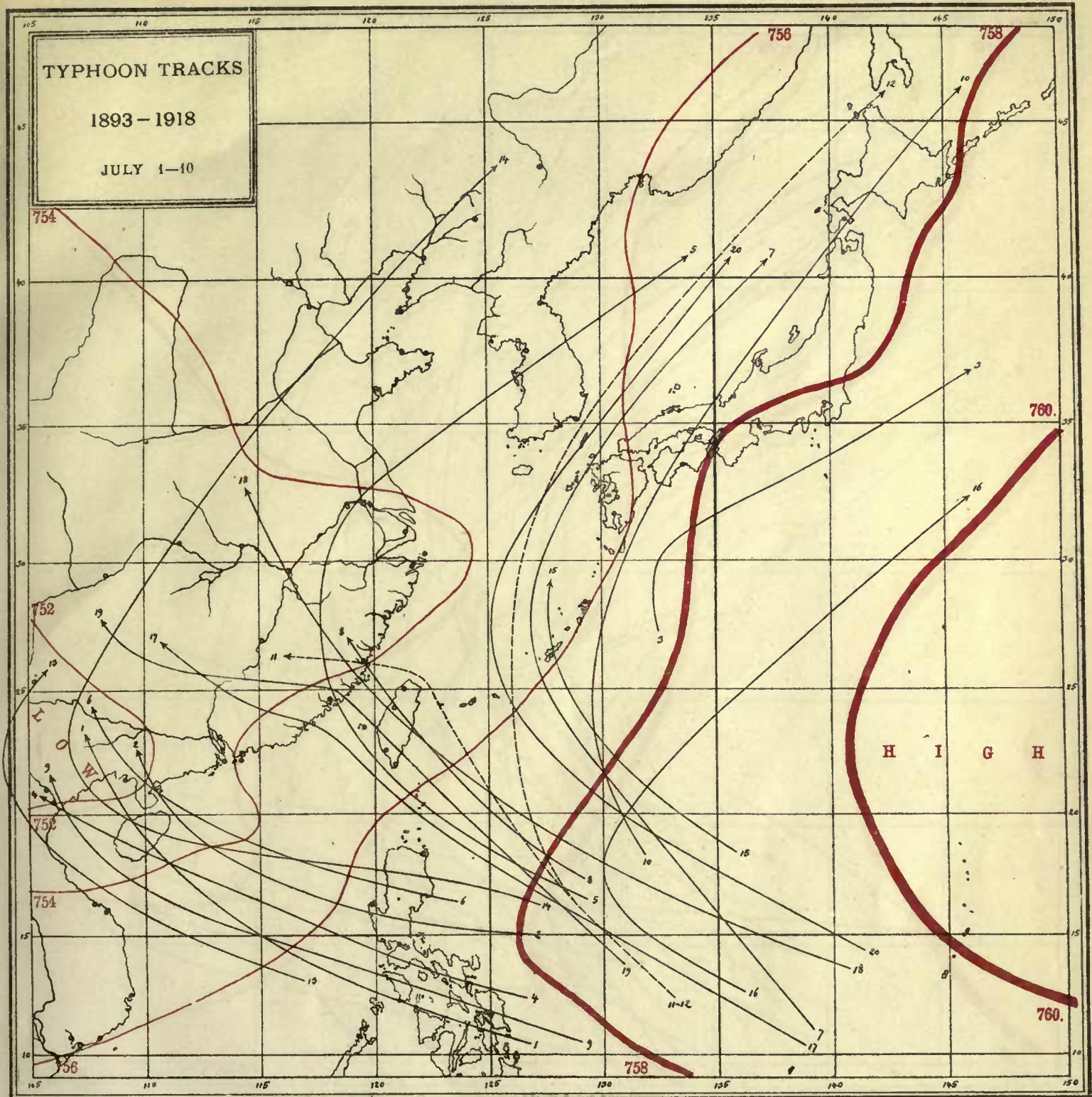


JUNE. — Single chart : 34 tracks ; a little more than one case every year.

The tropical storms have not much increased in numbers, but the translation of their movement towards the NW is asserting itself more and more. The Philippines are crossed freely, Hainan and the Gulf of Tongking receive more numerous visits, but the more interesting feature for us is that the coast of China is no more invulnerable ; the typhoons may strike Kwangtung and even two instances give the warning that they can rise up to Foochow, and pay a visit, after recurving inland, to the mouth of the Yang-tze kiang.

The recurving of the trajectories takes place, with a fair degree of regularity, in the neighbourhood of the Ballintang and the Bashi Channels, about the 20th parallel, in the great curve of islands formed by the Meiac-Simas, Formosa and northern Luzon. Thence the tracks are seen to start towards the NE, in great numbers, to sweep over the Loochoos, Kiushu and Nippon : a few ones begin even to cross the Sea of Japan.

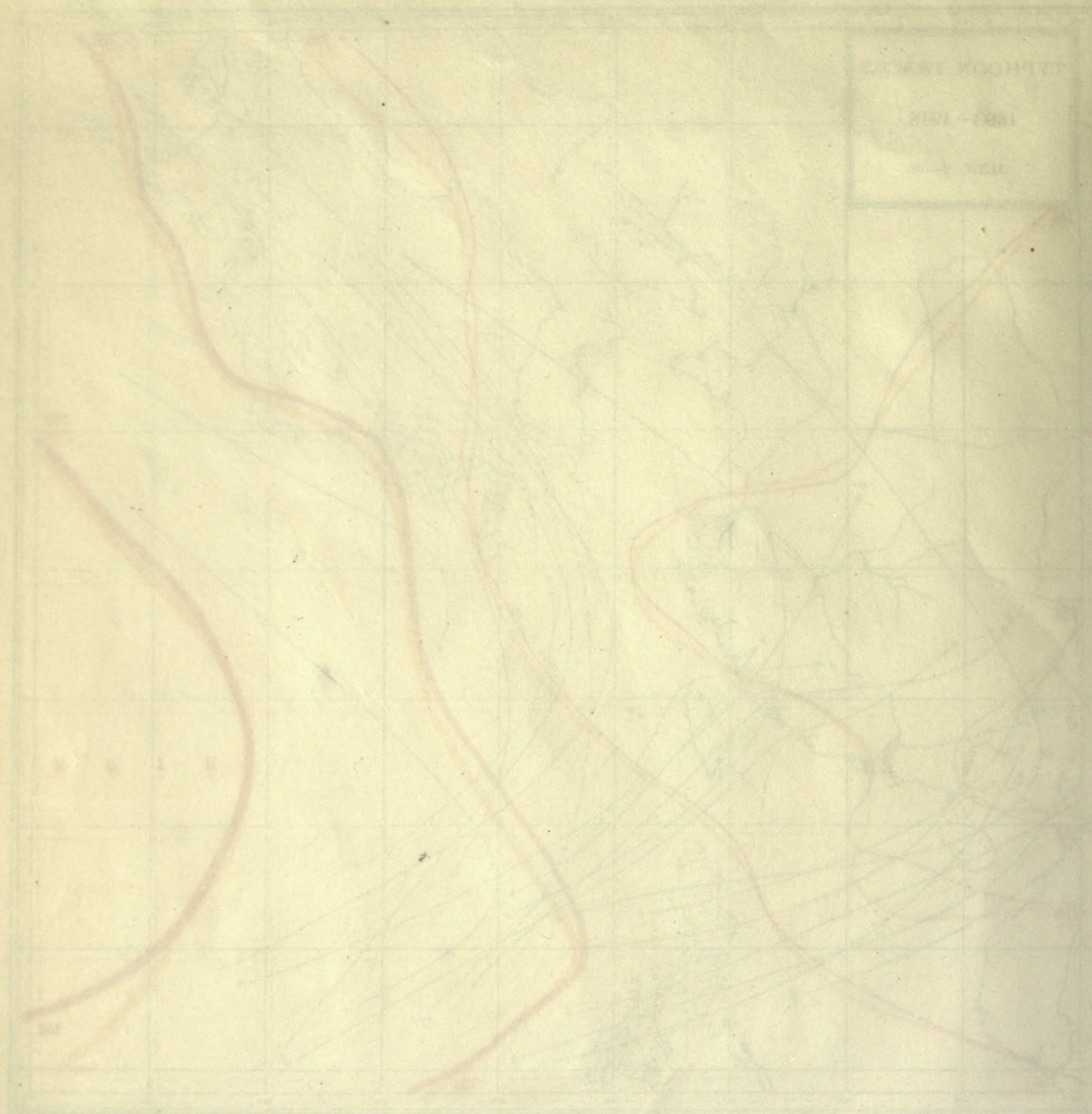
The corresponding arrangement of the pressures deserves to be noticed : a distinct minimum has replaced the high plateau of the cold season on the Continent, as far as Mongolia, and on the other side, the maximum of the middle Pacific is throwing forward a spur that invades the Philippines. There is a striking parallelism between the so called "parabolas" of the typhoons and the isobaric lines surrounding the W end of the oceanic maximum.



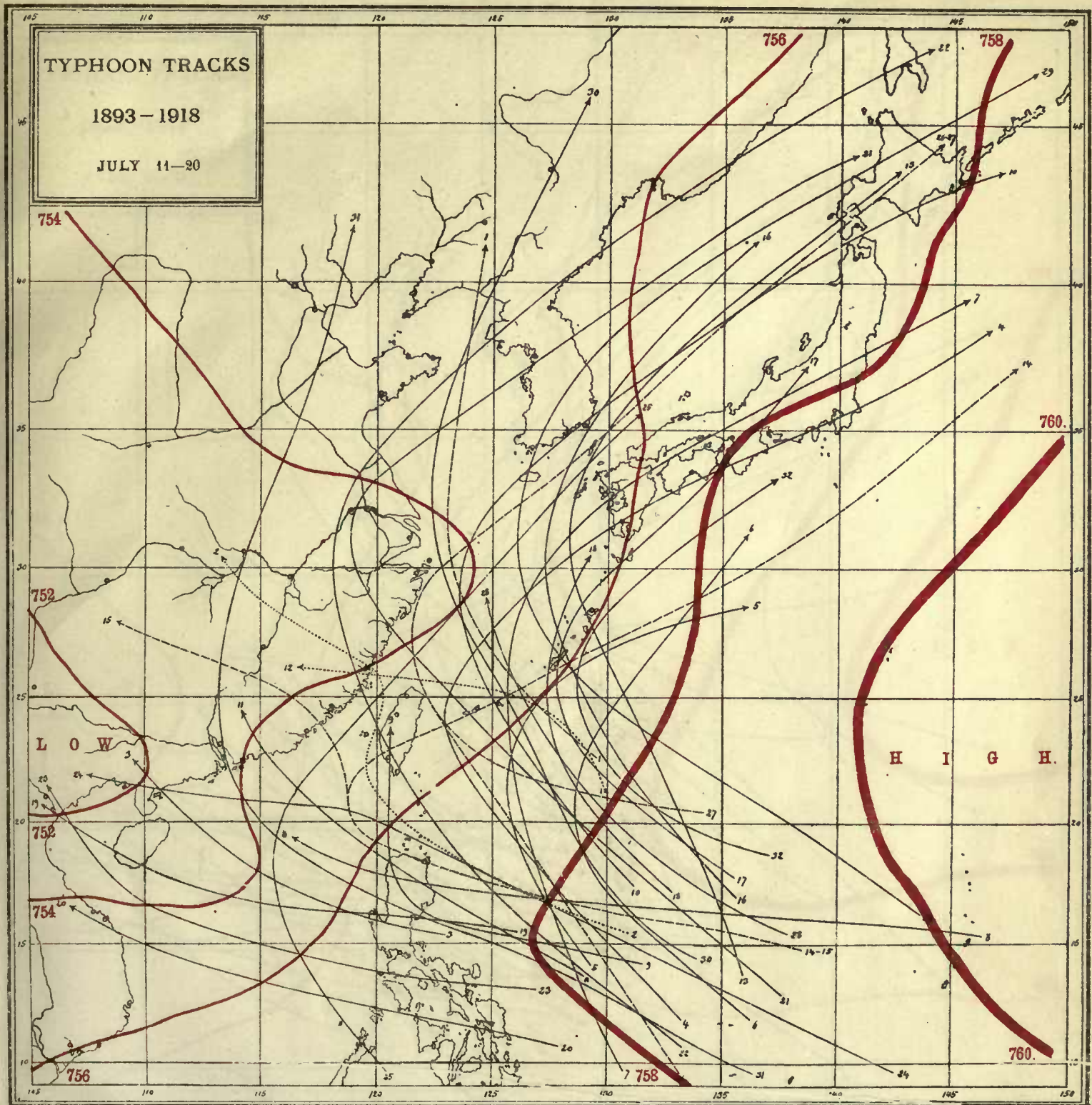
JULY. — Three charts : 90 tracks ; three or four instances every year.

First decade: July 1-10. — 20 tracks. — If we draw out these tracks to their beginning, we find that they mostly converge to one same spot, between the occidental Carolines and the southern Marianas, about latitude 10°, between Yap and Guam. Starting thence, they form three bundles distinctly separated from each other : the first one runs towards WNW, crosses the Philippines and the China Sea, between the 15th and the 20th parallels and lands between Kwangtung and Annam, with a marked preference for the Gulf of Tongking. The second group travels straight towards the NW, across Formosa, and strikes the coast between Swatow and Foochow : both are usually seen to fill up on land, without returning to the Sea. The third cluster, the eastern one, follows at first a path parallel to the second one, then recurves towards the NE, when crossing the Loochoos, and goes to sweep over the Japan Sea and Archipelago. It is very rare, during the beginning of July, to receive these dreaded visits between Chusan Is., Korea and the Gulf of Pechihli.

During the same period, the minimum has continued to grow deeper and deeper on the Continent, chiefly in northern Tongking ; on the other hand, although the isobar 758^{mm} has retired a little eastwards, the oceanic maximum continues to make itself felt over the Carolines, the Marianas and the Bonin group.



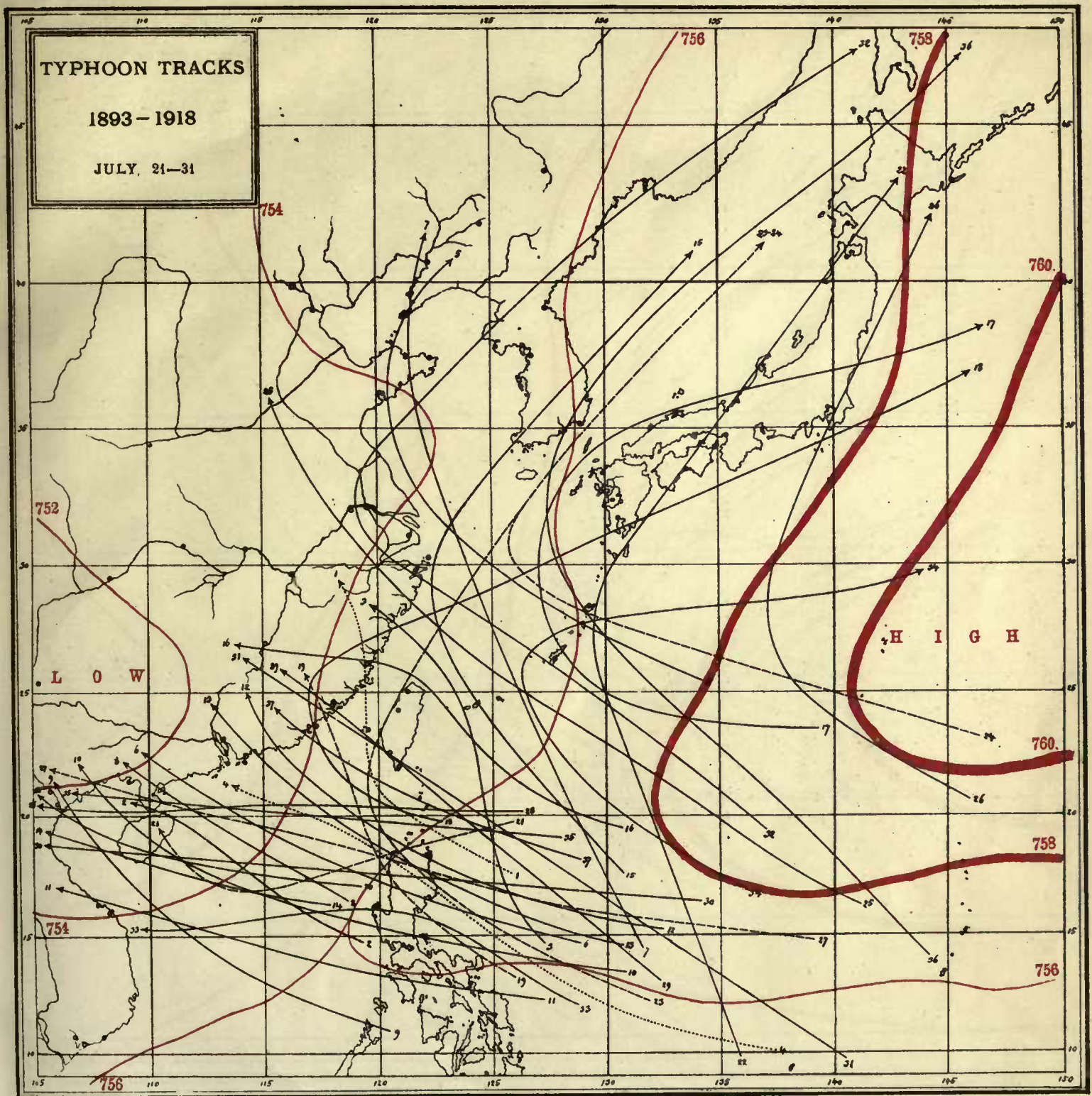
1883-1884. The map shows the temperature isotherms for the years 1883-1884. The isotherms are drawn in red ink, showing the temperature contours across the region. The map is titled 'TEMPERATURE IN THE EAST INDIES' and '1883-1884'.



JULY. — Three charts : 90 tracks ; three or four instances every year.

Second decade : July 11-20. — 32 tracks. — The more we advance into the typhoon season, the greater is the number of the storms ; the three bundles, separated during the first period of the month, are coming close together, and their lines cover a kind of *fan*, the handle of which is seen resting broadly between Yap and Guam, while the extreme edges or leaves lie down, on one side along the Loochoos and the S coast of Japan, on the other across the China Sea, from Palawan to the coast of Annam.

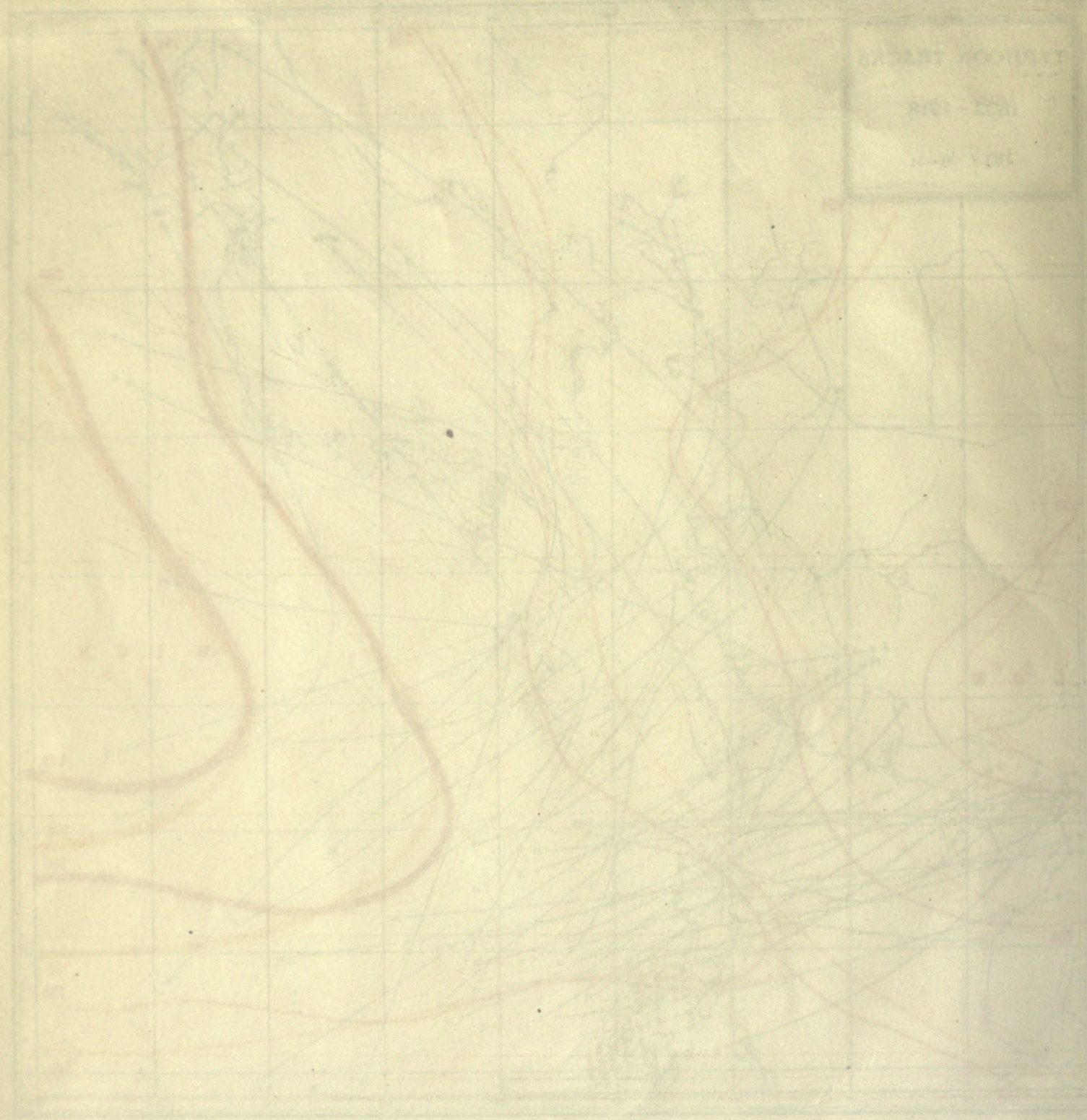
Henceforth no place on the coasts of China and Japan is under shelter : at the same time there is a remarkable immunity for the China Sea, below the 15th parallel, and the Pacific between the Marianas, the Bonin group and the neighbourhood of Tokyô. The turning point of the "*parabolas*" is found, more and more frequently, in the surroundings of the Loochoos, and farther North, between the 125th and the 130th meridians. The focus of the origin rests roughly at the same place as before, between the Carolines and the Marianas.



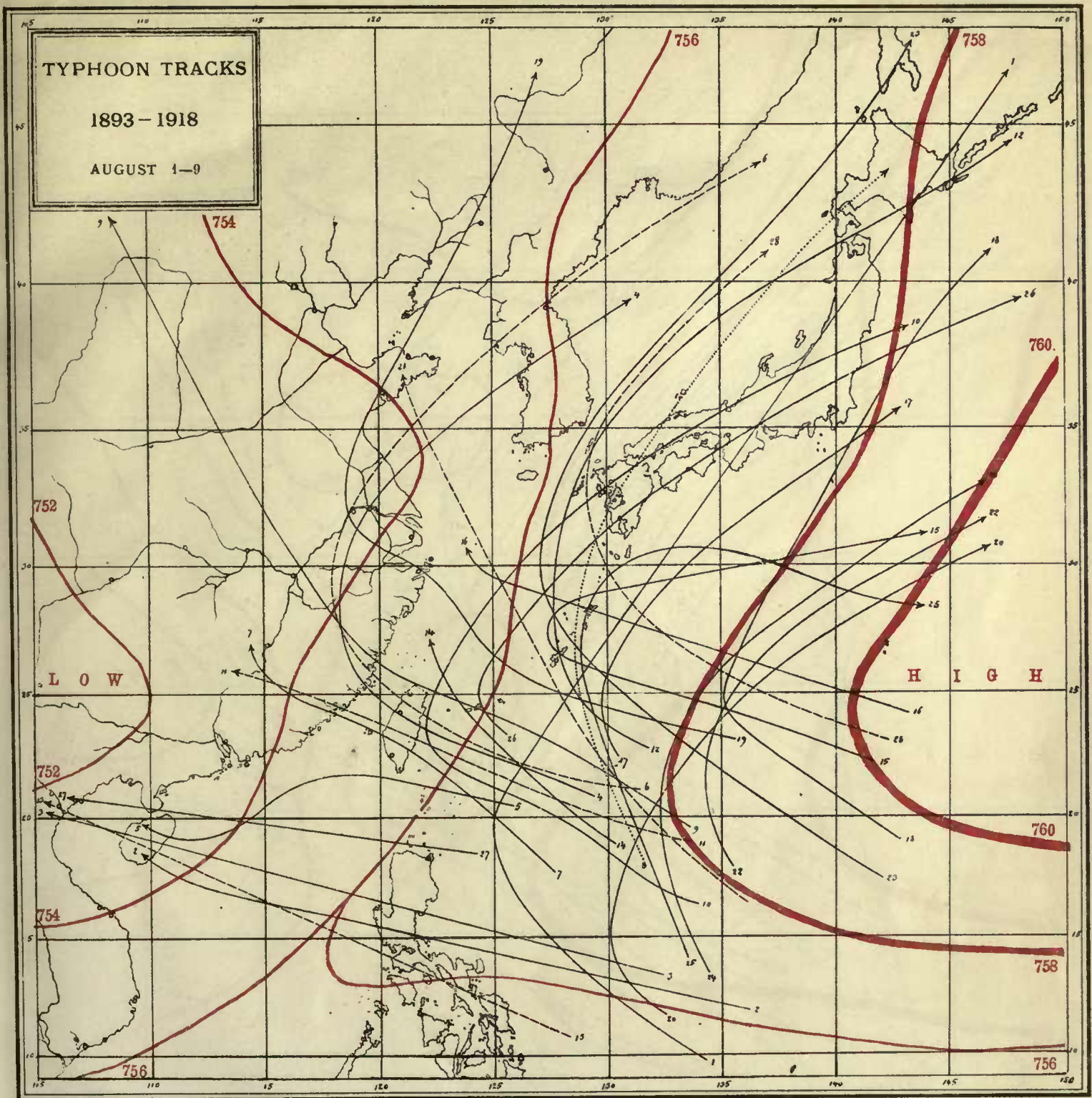
JULY. — Three charts : 90 tracks ; three or four instances every year.

Third decade: 21-31. — 37 storms. — The most striking feature of this period, is the obstinacy with which the typhoons come repeatedly to hit Hainan island and the Gulf of Tongking. At a time when the storms have diminished in Japan, the straight trajectories are seen to gather, to follow each other on both sides of the 20th parallel, and running as a rule towards WNW, strike the coast between Kwang-chow-wan and Vinh in the South of the Gulf. The China Sea, to the South of the Paracels remains clear of typhoons during the middle of the month, and the Pacific, between the N. Marianas and the SE corner of Japan is remarkably free too.

Some great typhoons trace now very large paths on the Eastern and the Yellow Seas : they may recurve off the Saddles, and even farther West, across the Blue River, near Nanking and Chinkiang. Let us observe that a relatively small number of them draw the so called "parabola" ; the very great majority come to land without recurving and disappear on the Continent between Thibet and the western provinces of China. A fact, rare as it may be, must not pass unnoticed : on the China Sea a few tracks are traced due West, or even (Nos. 21 and 23) in a WSW direction.



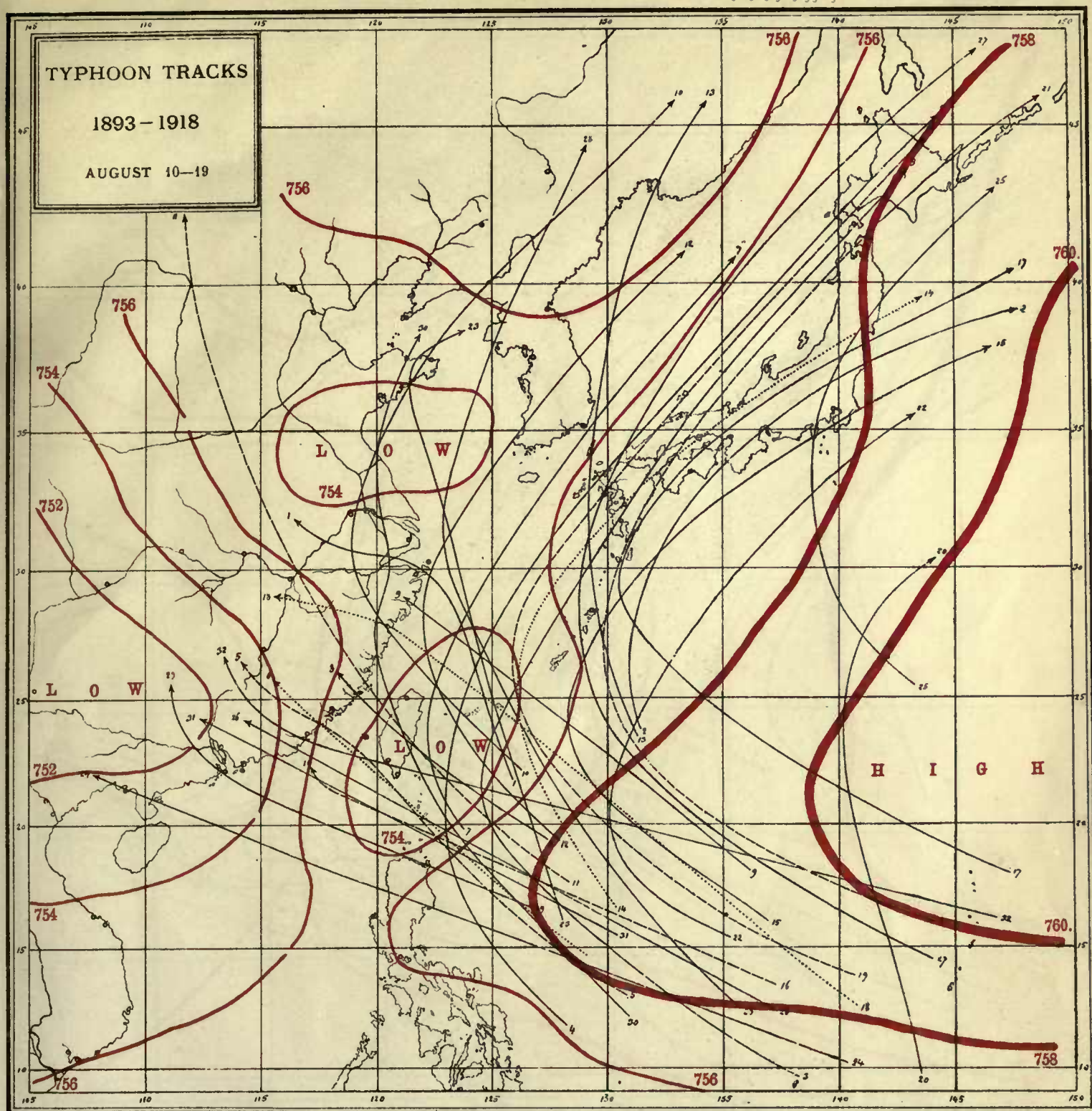
The map shows the coastline of the island of Sumatra, with the Bay of Bengal to the west and the Indian Ocean to the east. The map is drawn with red and blue lines. The title 'CHART II' is in the top left corner, and 'EXPLANATIONS IN THE TABULAR PART' is in the top center. The map shows the coastline of the island of Sumatra, with the Bay of Bengal to the west and the Indian Ocean to the east. The map is drawn with red and blue lines. The title 'CHART II' is in the top left corner, and 'EXPLANATIONS IN THE TABULAR PART' is in the top center.



AUGUST. — Three charts : 92 tracks ; three or four instances every year.

First decade : 1-9. — 28 storms. — The ensemble of the trajectories executes a vast oscillation to the eastward : the visits to the Gulf of Tongking are less frequent, and the whole of the China Sea is nearly free, to the South of Haïnan. On the contrary, the centres appear, more numerous, between the Bonin group and Japan, and the paths they follow are recurving more frequently at sea, along the 25th parallel, in a fairly wide space, between the 135th meridian and Formosa ; some are even advancing, in a NW direction, pretty far inland, and reach their apex near the 30th parallel, between the 115th and the 120th meridians, where they start again towards the NE.

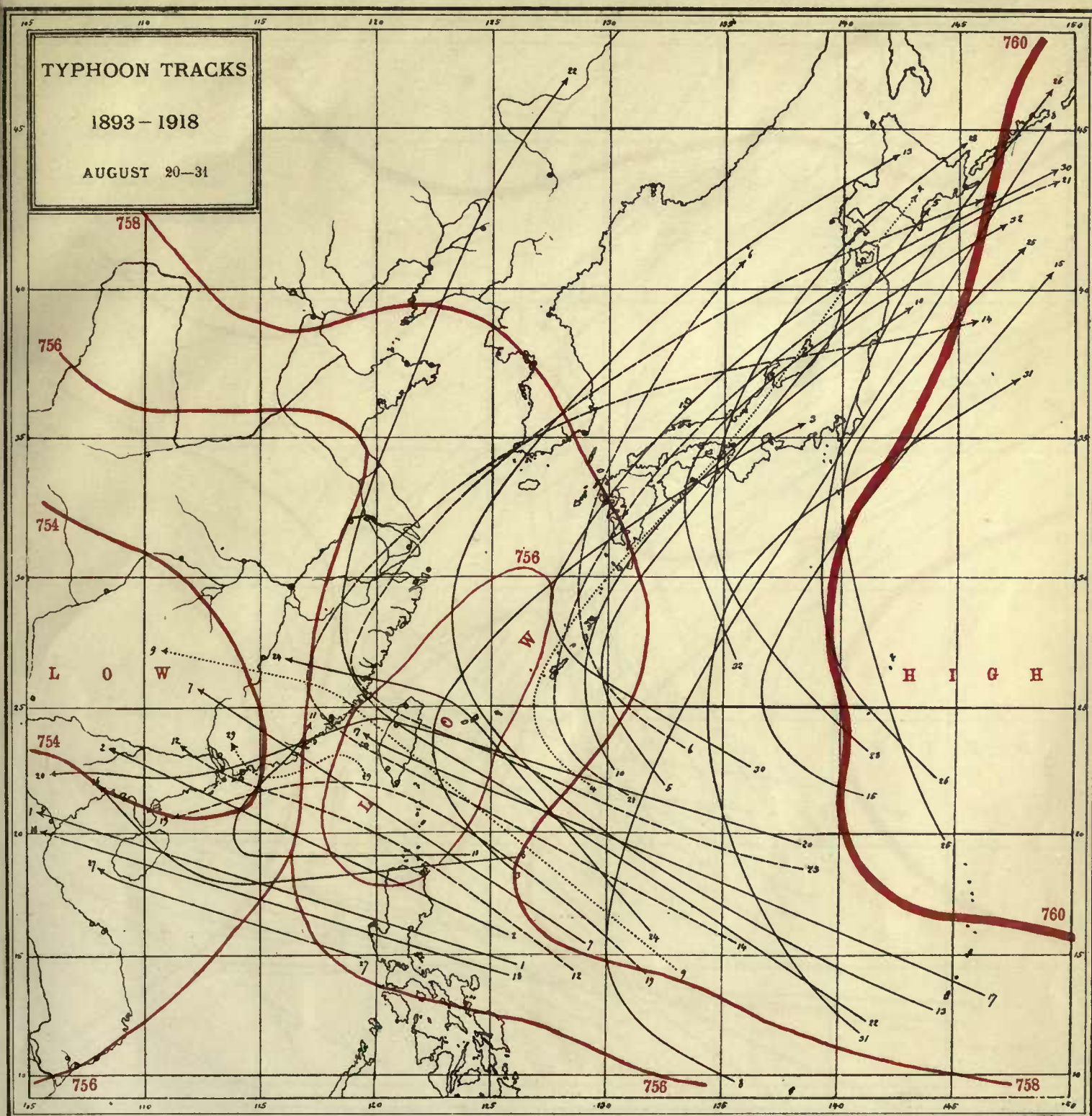
During the present period, the whole space from Haiphong to the Bonin is open to the incursions of the dreaded visitors, the Formosa Strait and the Korea Strait having their preference. Some of them strike the coast, between Amoy and Wenchow, to recurve on land, and appear again, with a new energy, on the Yellow Sea or the Gulf of Pechihli. We may notice that, during the decade, the isobars 758^{mm} and 760^{mm} have receded a little towards the East : it is in accord with the motion of the tracks the same way.



AUGUST. — Three charts : 92 tracks ; three or four instances every year.

Second decade : 10-19. — 32 storms. — A new grouping of the trajectories takes place visibly during the middle of the hottest month. Deserting the extreme East and West, they gather in a dense bundle, a kind of *fan*, having this time its handle midway between the S. Philippines and S. Marianas, and the edges, drawn on one side over Hongkong, on the other across southern Nippon and the Kii Channel. It is one of the most dangerous periods in the Formosa Strait, the Eastern Sea and at the mouth of the Yangtze. It is important to note how the Philippines and the whole of the China Sea are almost entirely out of the dangerous zone during this time of the year. The tracks that recurve towards Japan, in great numbers, have now their apex or turning point on both sides of the 130th meridian and in the neighbourhood of latitude 30°.

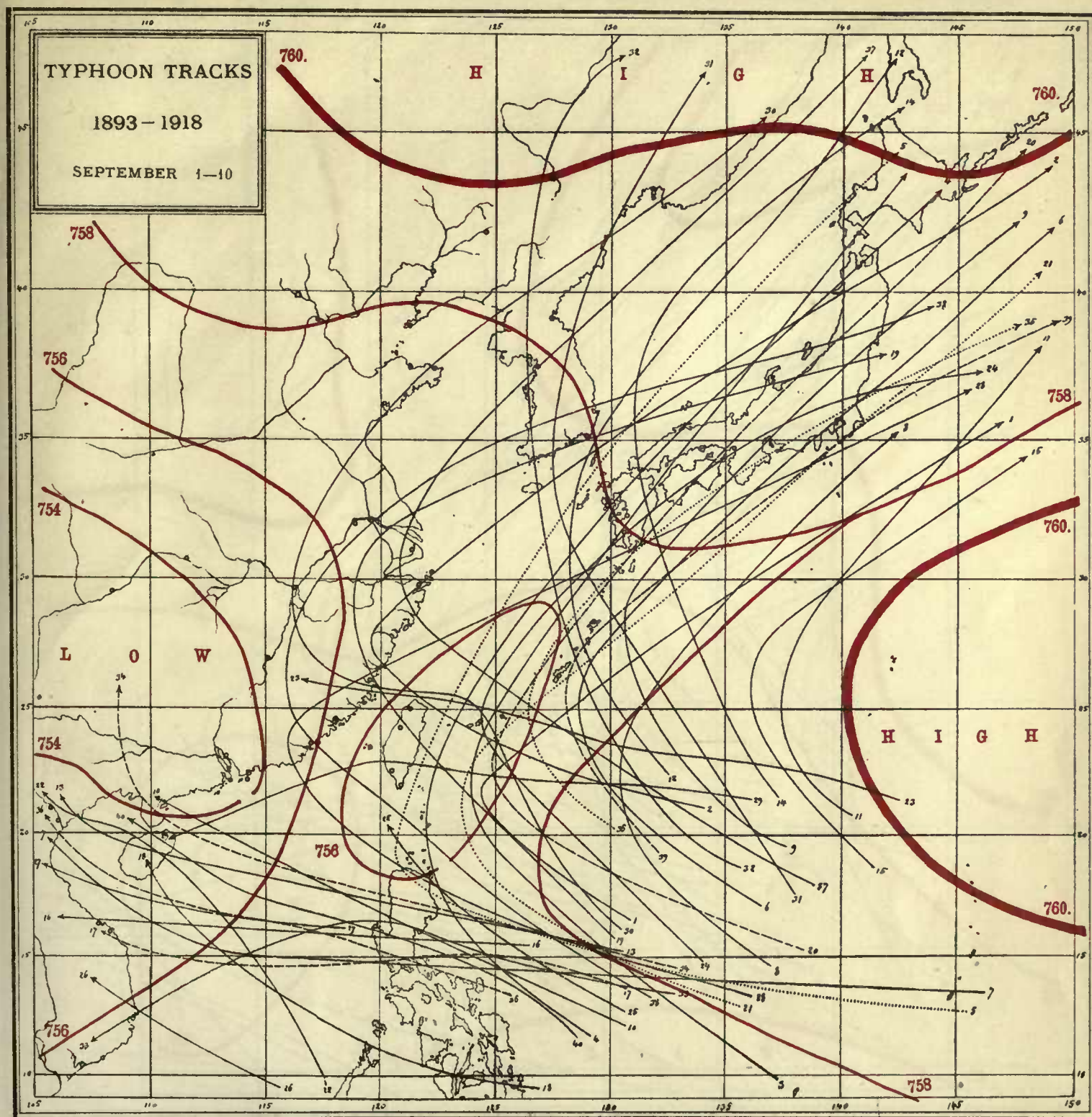
We must remark here a deep change in the arrangement of the pressures : while the spur formed by the isobar 758^{mm} has come back to the vicinity of Luzon, two distinct areas of low readings have developed astride of longitudes 120° and 125°, the one enveloping Formosa and the Channels South of it, the other having its middle axis along the coast of Kiangsu with a N-S direction and covering the whole western half of the Yellow Sea.



AUGUST. — Three charts : 92 tracks ; three or four instances every year.

Third decade: 20-31. — 32 storms. — The opening of the bundle or *fan* formed by the tracks is a remarkable feature of the end of August. The middle of it is less dense, and the trajectories traced by the centres are gathering more towards the edges which glide on one side as far as the Gulf of Tongking, on the other on the Marianas, the Bonin group and the eastern shores of Nippon. The Formosa Strait remains a very dangerous place, but we must note that the storms in the middle of the *fan*, appear to find it more and more difficult to reach the coast to the N of Foochow, and many of those which come inland between Foochow and Hongkong are exhausted and die away after a short life on the Continent.

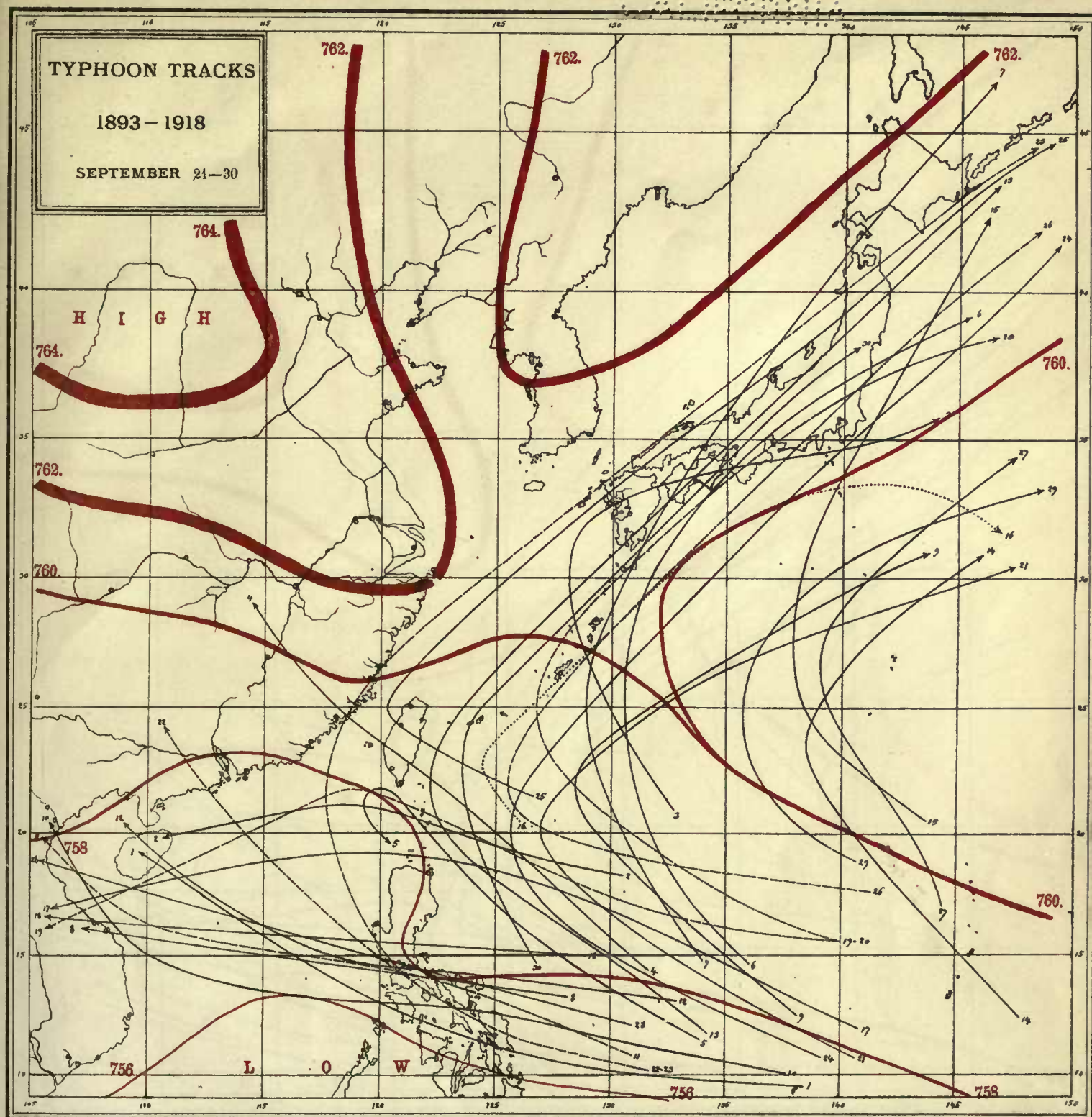
One feels that the great asiatic anticyclone is slowly approaching, and its advance though still distant, is gradually barring the way to the tropical depressions, and preparing a rent in the middle of the *fan* by bending the tracks, on one hand towards the southern provinces of China, on the other towards Japan. The isobaric line 758^{mm} which kept on eastern Japan during the middle of the month, has travelled an immense way westwards, bending across Korea and the Gulf of Pechihli ; at the same time the two depressions of the Chinese coast are at a higher level, and have coalesced into one single elliptical area, between lat. 18° and 30°, long. 118° and 127°, with Formosa just in the middle.



SEPTEMBER. — Three charts : 109 tracks ; the maximum of typhoons, a little more than 4 instances every year.

First decade: 1-10. — 40 tracks. — During these ten days the typhoons are more numerous than during the whole of June. However the presence of the asiatic maximum makes itself felt more and more ; five storms only have crossed the Yellow Sea and the Formosa Strait becomes less dangerous by degrees. At the same time the two extreme edges of the fan of tracks extend themselves on both sides and show an increasing density of trajectories. On the SW side, the centres, advancing straight towards NW or WNW, rush in increasing numbers towards Tongking and Annam, and the dangerous zone gains ground as far as Palawan and the coast of Cochin-China. In the East, the season is in full swing across Japan and down to the Bonin group. A few cyclones continue to visit the N of Formosa and come to recurve inland near the mouth of the Yangtze.

The apex or turning point of the curves is gradually going down southwards, and the movement occurs frequently, to the SE of the Loochoos and the E of the Bashi Channel, between the 122th and the 130th meridians. The handle of the fan passes close to the eastern coast of Luzon, and not a few centres emanate from latitudes below 10°. The reader will remark at least two tracks running distinctly towards WSW on the China Sea. He will also note a kind of parallelism between many *parabolas* and the curve of the isobar 758^{mm} on the Pacific.

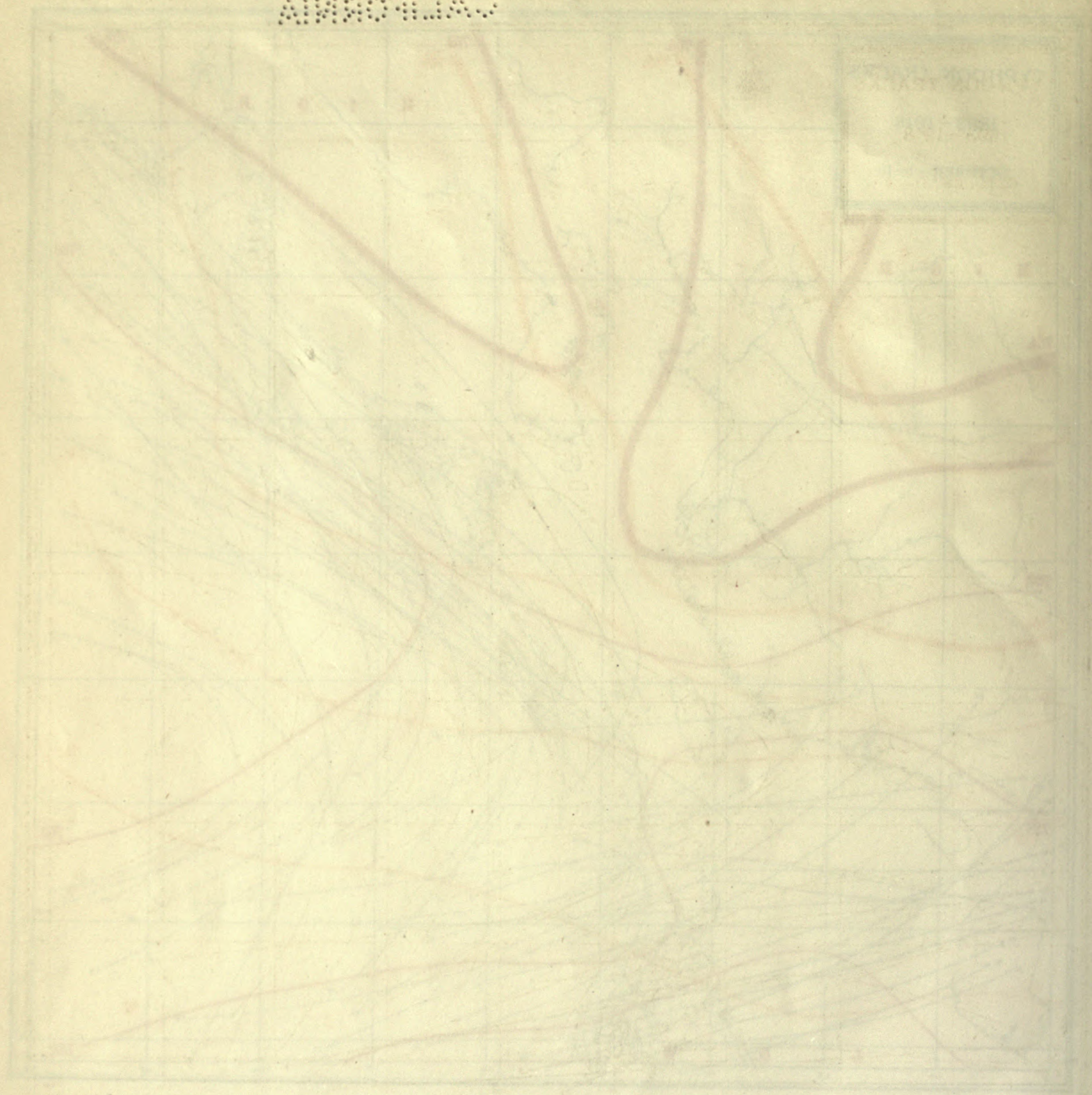


SEPTEMBER. — Three charts: 109 tracks; the maximum of typhoons, a little more than 4 instances every year.

Third decade: 21-30. — 29 tracks. — The rent in the central part of the bundle or fan of storms is steadily progressing and broadening. Only two trajectories have ploughed their way across the Eastern Sea from SW to NE, and no case is signalled to the N. of a line joining Wenchow to the SW end of Hokkaido, across the Korea Strait. Japan is still frequently run over from end to end, as well as the Bonin islands. The China Sea has become more calm, but for a short time, to the S of the 15th parallel, while the N part of it is still freely opened to the incursions of the typhoons, which continue, in a few cases, to recurve to WSW between the Ballintang Channel and the coast of Annam.

The birth place of the storms continues to retire southwards, between the Carolines and Mindanao. The recurving points (*apex*) rather dispersed during the beginning of the month, come close together, to the E of the Bashi and Ballintang Channels, not far from the 20th parallel; a few ones are rounding the Bonin group.

The spur of the high pressures, marked by the isobar 762^{mm} envelops now the mouth of the Yangtze, and the local minimum of S. China has disappeared. The few tracks that reach our coasts do not go very far inland, the low centres being soon filled up by the high pressures of the Continent.



1. The first typhoon of the season struck the coast of California on August 1st. It was a very strong storm, with winds reaching a velocity of 100 miles per hour. It caused considerable damage to the coast, and many lives were lost. The storm was followed by a heavy rain, which caused the rivers to overflow. The water was very muddy, and the people who lived in the lowlands were in great danger. The storm was the first of a series of typhoons that struck the coast of California in 1900.

2. The second typhoon struck the coast of California on August 15th. It was a very strong storm, with winds reaching a velocity of 100 miles per hour. It caused considerable damage to the coast, and many lives were lost. The storm was followed by a heavy rain, which caused the rivers to overflow. The water was very muddy, and the people who lived in the lowlands were in great danger. The storm was the second of a series of typhoons that struck the coast of California in 1900.

3. The third typhoon struck the coast of California on August 30th. It was a very strong storm, with winds reaching a velocity of 100 miles per hour. It caused considerable damage to the coast, and many lives were lost. The storm was followed by a heavy rain, which caused the rivers to overflow. The water was very muddy, and the people who lived in the lowlands were in great danger. The storm was the third of a series of typhoons that struck the coast of California in 1900.

4. The fourth typhoon struck the coast of California on September 14th. It was a very strong storm, with winds reaching a velocity of 100 miles per hour. It caused considerable damage to the coast, and many lives were lost. The storm was followed by a heavy rain, which caused the rivers to overflow. The water was very muddy, and the people who lived in the lowlands were in great danger. The storm was the fourth of a series of typhoons that struck the coast of California in 1900.

5. The fifth typhoon struck the coast of California on September 28th. It was a very strong storm, with winds reaching a velocity of 100 miles per hour. It caused considerable damage to the coast, and many lives were lost. The storm was followed by a heavy rain, which caused the rivers to overflow. The water was very muddy, and the people who lived in the lowlands were in great danger. The storm was the fifth of a series of typhoons that struck the coast of California in 1900.

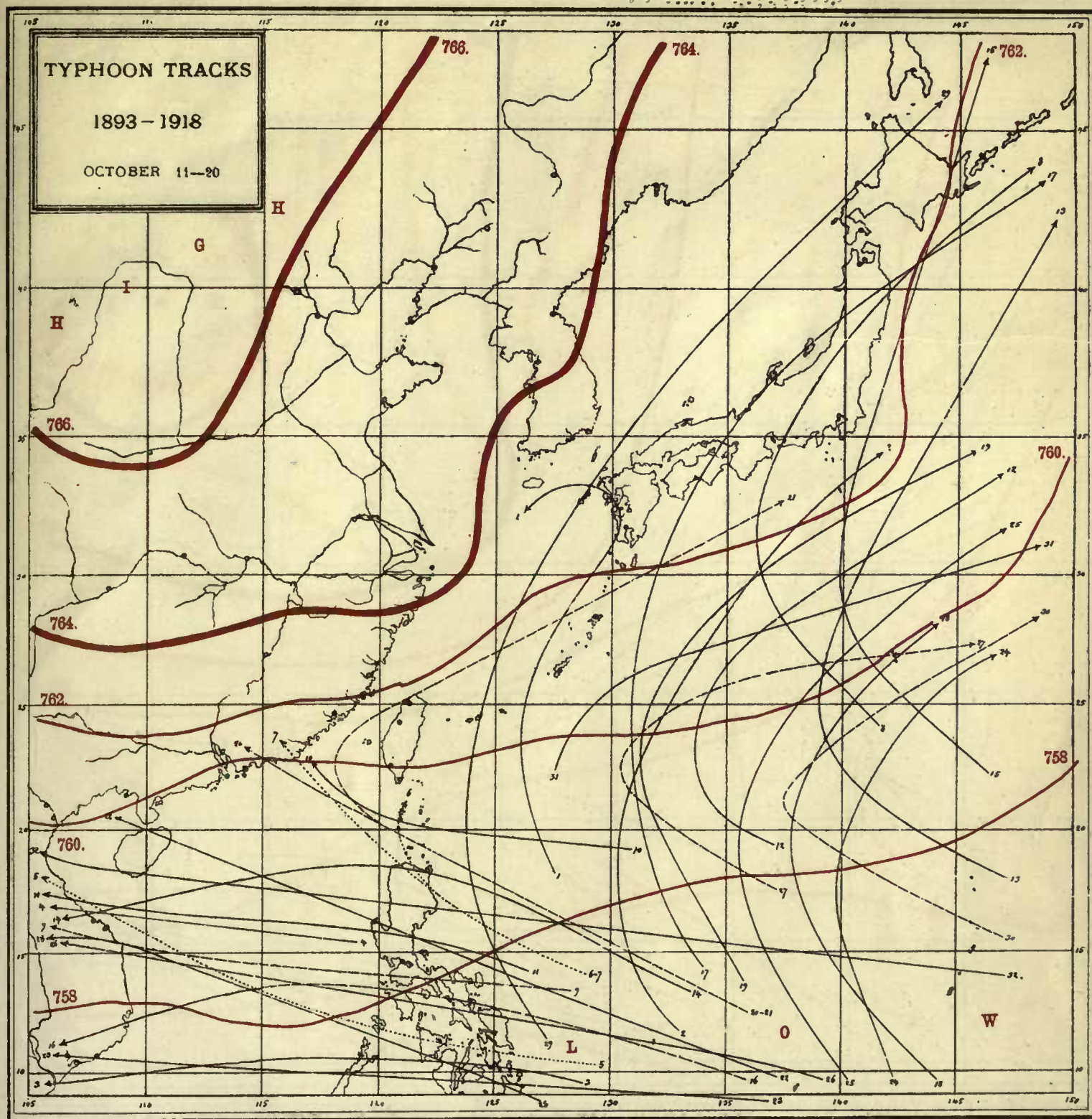
6. The sixth typhoon struck the coast of California on October 12th. It was a very strong storm, with winds reaching a velocity of 100 miles per hour. It caused considerable damage to the coast, and many lives were lost. The storm was followed by a heavy rain, which caused the rivers to overflow. The water was very muddy, and the people who lived in the lowlands were in great danger. The storm was the sixth of a series of typhoons that struck the coast of California in 1900.

7. The seventh typhoon struck the coast of California on October 26th. It was a very strong storm, with winds reaching a velocity of 100 miles per hour. It caused considerable damage to the coast, and many lives were lost. The storm was followed by a heavy rain, which caused the rivers to overflow. The water was very muddy, and the people who lived in the lowlands were in great danger. The storm was the seventh of a series of typhoons that struck the coast of California in 1900.

8. The eighth typhoon struck the coast of California on November 9th. It was a very strong storm, with winds reaching a velocity of 100 miles per hour. It caused considerable damage to the coast, and many lives were lost. The storm was followed by a heavy rain, which caused the rivers to overflow. The water was very muddy, and the people who lived in the lowlands were in great danger. The storm was the eighth of a series of typhoons that struck the coast of California in 1900.

9. The ninth typhoon struck the coast of California on November 23rd. It was a very strong storm, with winds reaching a velocity of 100 miles per hour. It caused considerable damage to the coast, and many lives were lost. The storm was followed by a heavy rain, which caused the rivers to overflow. The water was very muddy, and the people who lived in the lowlands were in great danger. The storm was the ninth of a series of typhoons that struck the coast of California in 1900.

10. The tenth typhoon struck the coast of California on December 7th. It was a very strong storm, with winds reaching a velocity of 100 miles per hour. It caused considerable damage to the coast, and many lives were lost. The storm was followed by a heavy rain, which caused the rivers to overflow. The water was very muddy, and the people who lived in the lowlands were in great danger. The storm was the tenth of a series of typhoons that struck the coast of California in 1900.

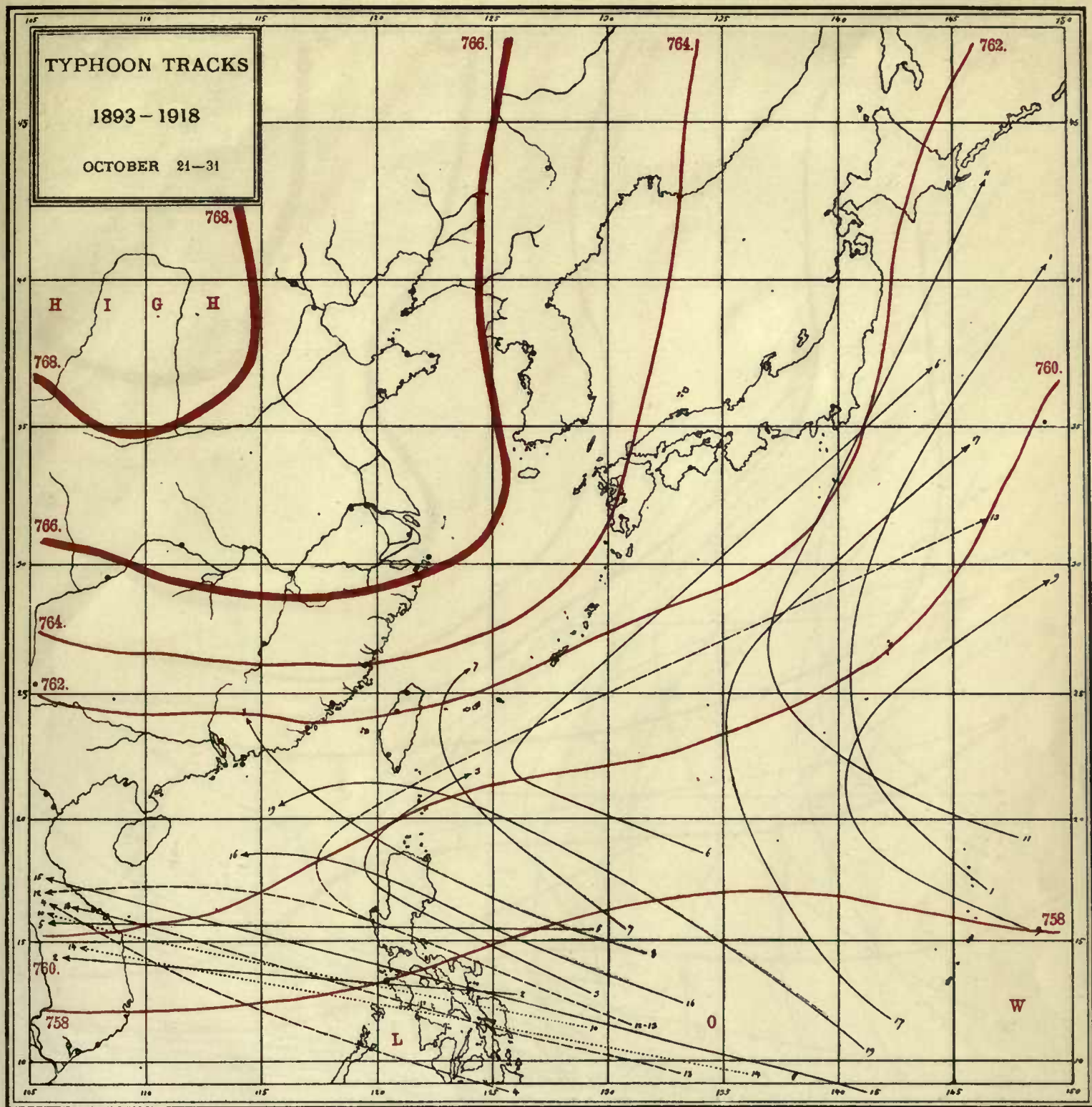


OCTOBER. — Three charts: 95 tracks; three or four instances every year.

Second decade: 11-20. — 32 tracks. — The number of typhoons has decreased from 44 to 32 since the first decade, and we are going out of the typhoon season proper: the beginning of the month accounted for nearly the half of all the tracks of October. Now three centres only have ventured as far as the coast of Kwangtung; Formosa, the Eastern Sea and the Sea of Japan are practically a forbidden territory for the tropical storms. Some trajectories are scattered between the Bonin group and the S. coast of Japan, where they do not form a dense bundle gathered close to a mean direction.

But at the same time an increasing activity is shown in the China Sea where the typhoons, keeping away from the Gulf of Tongking, come mostly to strike the coast between the extreme N. of Annam and lower Cochin-china with a great attraction towards the Paracels. Several centres have travelled straight from Palawan to Cochin-china: two more tracks are bent towards WSW. — The origin of the depressions is going down more and more to the S. of Yap.

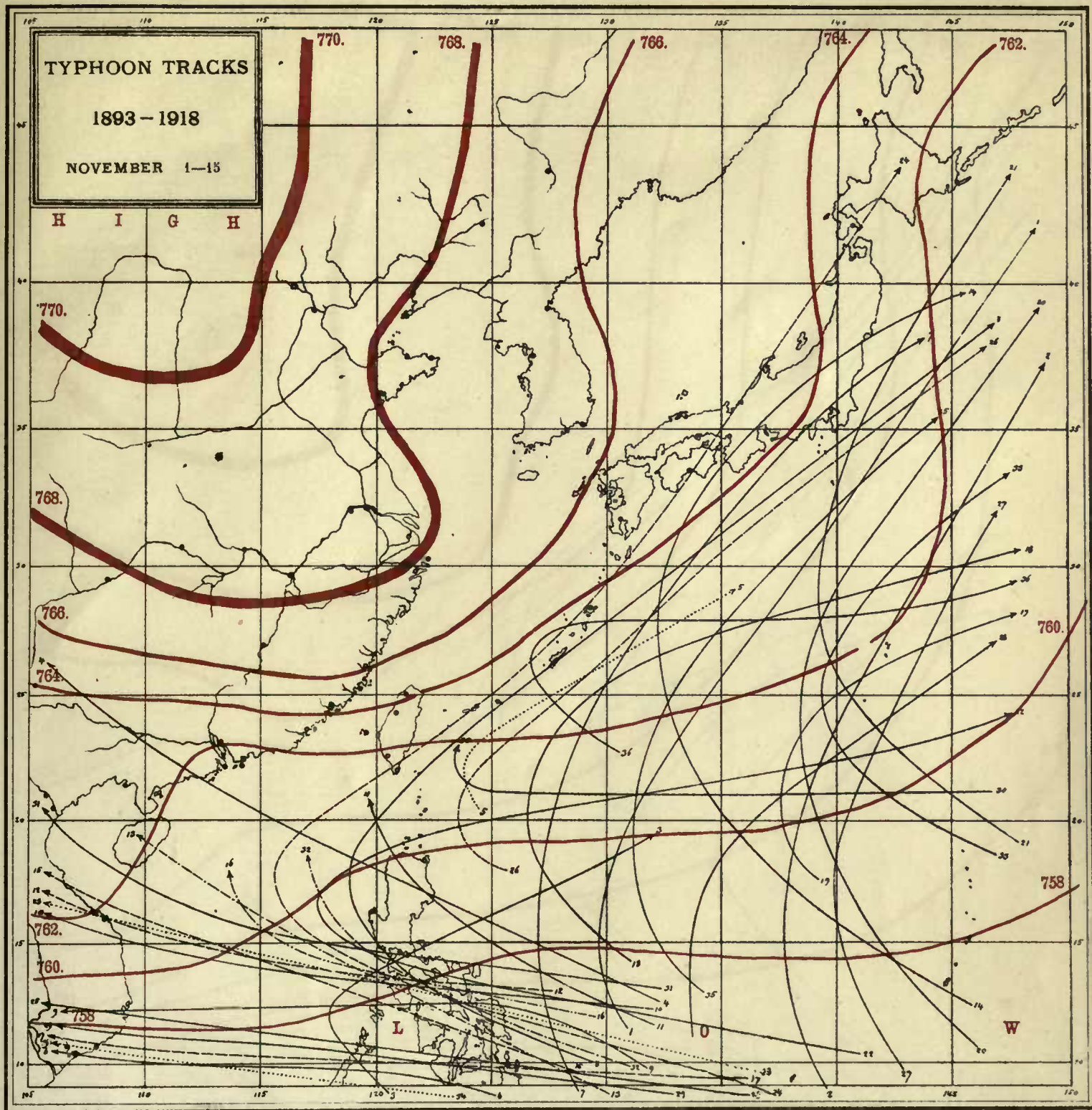
Let us remark that, during this period, there is a broadening of the continental anticyclone; instead of the narrow spur projected previously towards the coast. Thus the isobar 764^{mm}, after running parallel to the Yangtze to reach the sea at Wenchow, bends there



OCTOBER. — Three charts: 95 tracks; three or four instances every year.

Third decade: 21-31. — 19 tracks. — The number of typhoons is steadily decreasing: we do not find one typhoon every year during the 10 last days of the month; and we may say that their season is over, as far as the East of the 130th meridian is concerned. Only a few trajectories are seen between the Marianas and the Loochoos, and very few centres venture up to the Ballintang Channel, where they are soon repulsed or filled up. All the space to the NW of a line drawn up from the S end of Formosa to the SE corner of Japan is now perfectly free from their incursions.

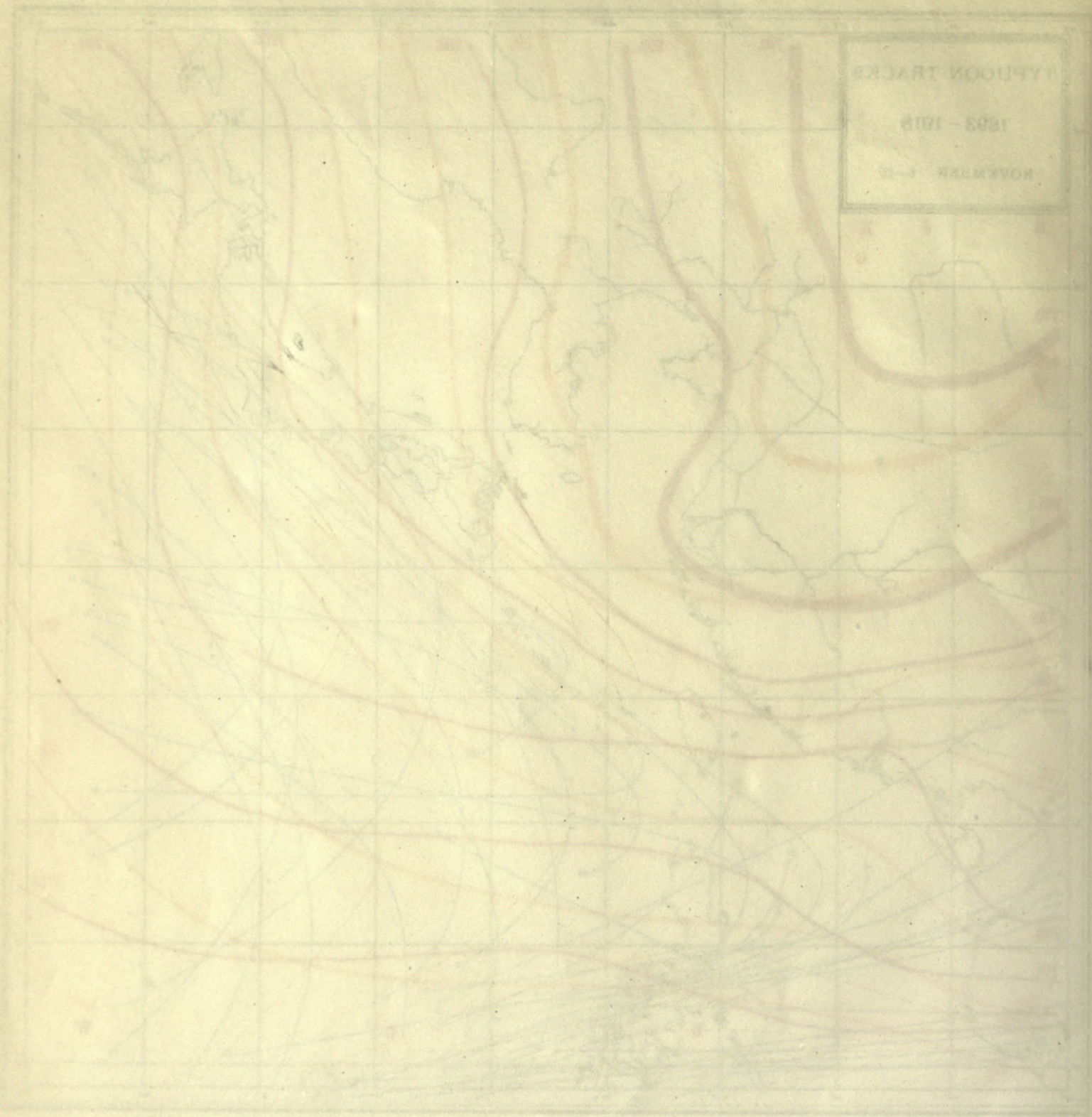
But it must be remembered that the middle of the China Sea, along the 15th parallel, is still a dangerous region, and there remains a bundle of tracks, fairly dense, running from Palawan or the S. of Luzon towards the coast of Annam, in the neighbourhood of Tourane. The Gulf of Tongking and Haïnan Island are practically free during this end of the month. The isobar 764^{mm} that has gained ground, by some 4 degrees, towards the South and the East, appears to be a kind of barrier impassable to the typhoons.



NOVEMBER. — Two charts: 52 tracks; two instances every year.

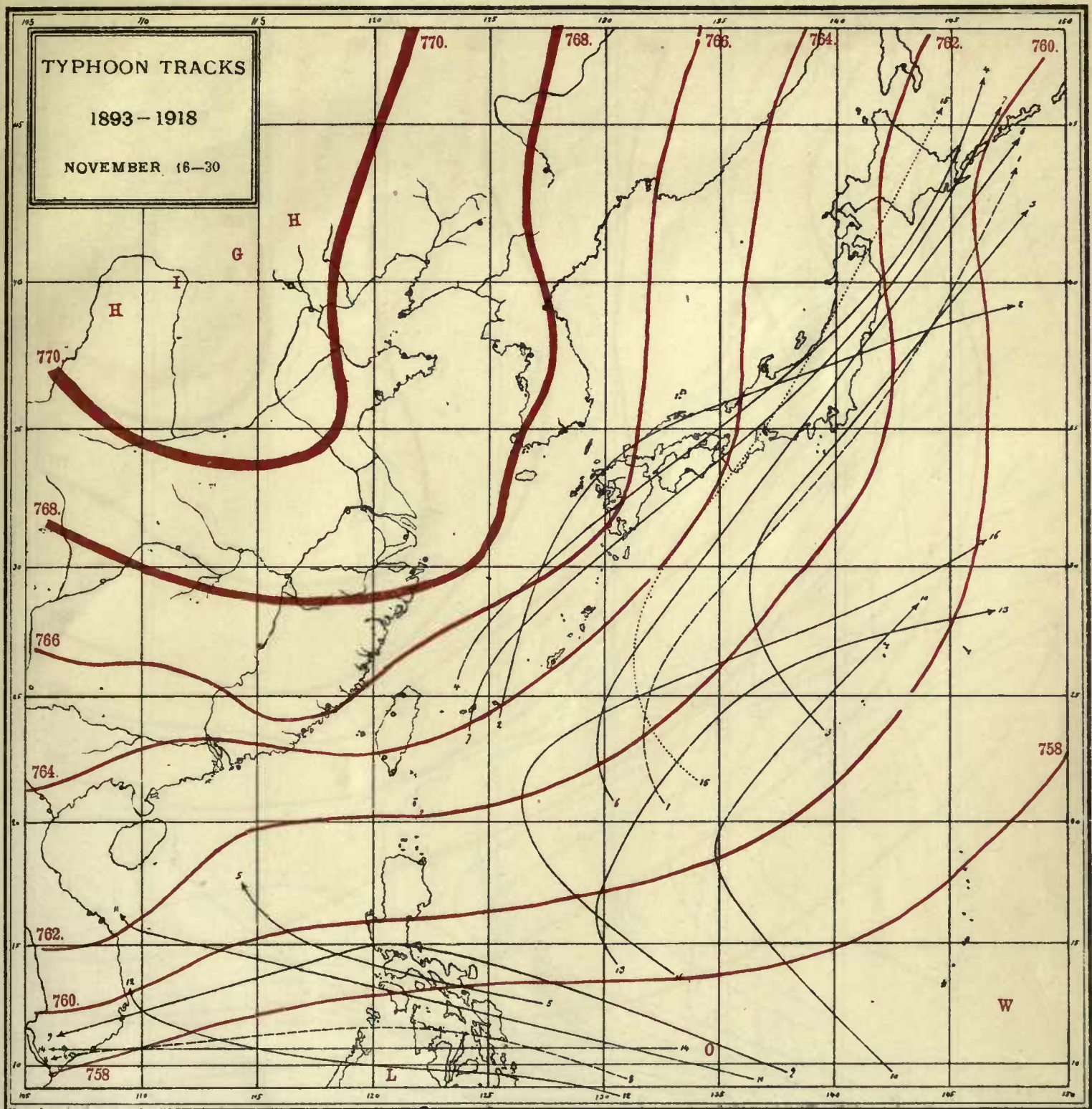
First fortnight: 1-15. — 36 tracks. — The high pressures of the continent have succeeded to expulse the typhoons from the Sea of Japan, the Eastern Sea and the Channels between Formosa and Luzon. No case has been recorded to the NW of a line running from the Pratas to the S. point of Hokkaido. It may be noted that the isobar 764^{mm} forms again a kind of frontier against the oceanic storms, from Swatow to Formosa, thence to the Van Diemen Strait and across Central Japan.

The point from which the trajectories are issued has retired to the low latitudes, about 5° to 8°, to the SW of Yap. Not a few tracks are recurving on the Pacific to the S of Japan, with a marked preference for the N Marianas and the Bonin. On the China Sea there is rather an increase of activity, it is like the last battlefield of the typhoons, divided in two columns, the one advancing from the Visayas to the coast of Annam, across the Paracels, the other travelling from Mindanao or Palawan to the shores of lower CochinChina, keeping their course between latitudes 9° and 12°.



TYPHOON TRACKS
1893-1918
NOVEMBER 1-10

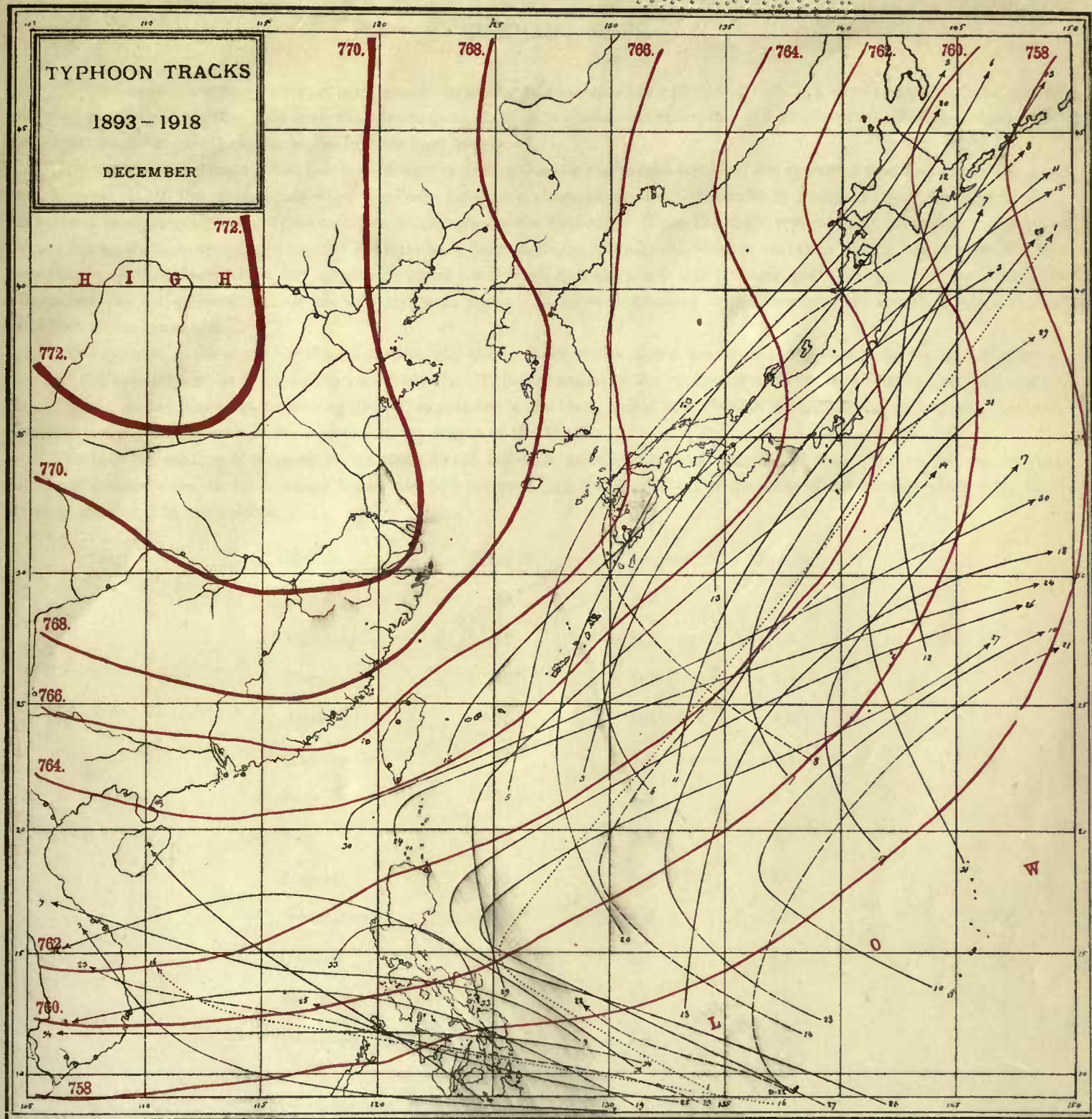
NOVEMBER 1-10. The above is a summary of the typhoon activity in the Pacific Ocean during the month of November, 1893-1918. The tracks are shown as curved lines, indicating the direction and path of the typhoons. The map is based on the data collected by the United States Navy and the United States Weather Bureau. The tracks are shown for the entire month of November, and the lines are drawn in a way that shows the general direction of the typhoon's movement. The map is a valuable tool for understanding the patterns of typhoon activity in the Pacific Ocean.



NOVEMBER. — *Two charts: 52 tracks; two instances every year.*

Second fortnight: 16-30. — 16 tracks. — We find ourselves under the full influence of the high pressures emanating from the great asiatic anticyclone, and consequently the winter monsoon has established its reign along our coasts. A few trajectories are still found between Japan and the Bonin. Three times Japan has been crossed from end to end, but such depressions, born between Formosa and the Loochoos appear to be a kind of hybrid storms having a bond with the family of the continental depressions, rather than real typhoons.

On the China Sea too, the storms are gradually disappearing; and those which cross the 15th parallel meet soon with their death. The remaining energy is concentrated in those centres which circulate along the 10th parallel, between the S. Visayas and Cochinchina; one of the last ones at least has followed distinctly a WSW direction, from Manila bay to Cape Padaran. Let us add however that the month is not a peaceful one, to the N. of the Formosa Strait, for if the typhoons have left the field, it remains open to the Continental depressions, and the monsoon, with its NW or NE gales is often very hard to the ships sailing against it from Hongkong to the northern ports.



DECEMBER. — One chart: 34 tracks; a little more than one instance every year.

The radiating point, or birth-place of the tropical storms, appears to have a movement backwards to the East, far to the S of Guam and the SE of Yap. The depressions, rare now and of decreasing intensity, are scattered, in the SW corner of the map, between Cape Padaran and Vinh, to the S of the Gulf of Tongking. Another bundle follows the same curve as during November, between the Marianas and Japan, most of them go away on the Pacific to the N. of the Bonin group.

A glance at the arrangement of the isobars gives an obvious reason for the general retreat of the oceanic storms; the line of 764^{mm} starts from the Gulf of Tongking, surrounds Formosa and the Loochoos, and crossing the Kii Channel, cuts in two halves the Sea of Japan along the 135th meridian. But very often the NE monsoon reaches the force of a full gale and there are records of powerful mail steamers taking five days for the run from Hongkong to Shanghai.

SUMMARY MAPS.

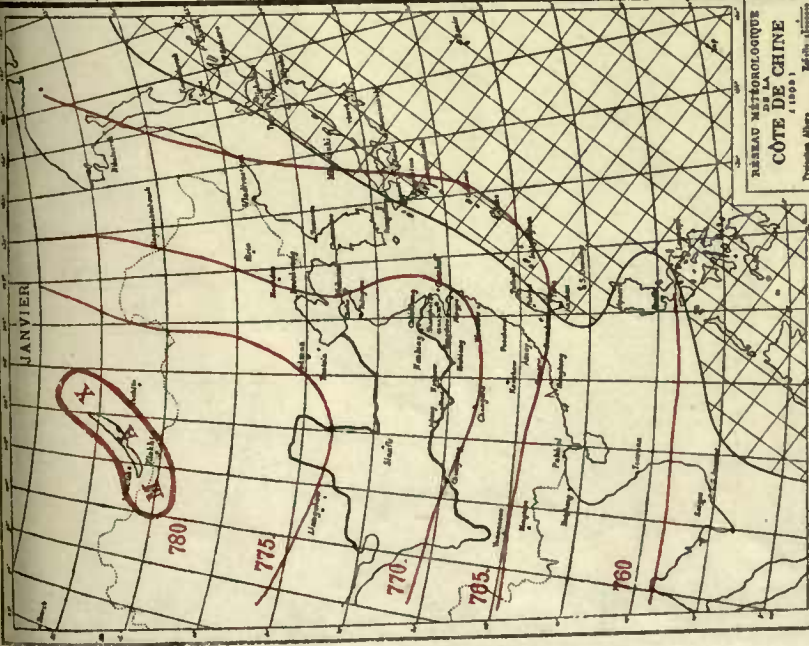
To conclude the present work, it has seemed interesting to sum up all the preceding data in a more condensed form. The twelve following charts, put together, will have the advantage to show, at a glance, the changes that take place in the Far-East, during the whole year, from month to month, as far as the typhoons are concerned.

On each of these maps a line has been drawn enclosing the more advanced tracks of the typhoons recorded during the month, for the 26 years. Then the whole space where typhoons have been observed has been shadowed by means of lines forming little squares, the squares being larger or smaller according to the number of the typhoons. Thus the shade represents in some way the density of the storms during the corresponding month. It would have been desirable to make the shadow darker in the places where the typhoons were more numerous themselves, but it has been found too difficult to make the design properly, and that chiefly for the more interesting months, and we had to content ourselves with giving an uniform shade corresponding to the density of the month, not to that of a particular spot of the map itself.

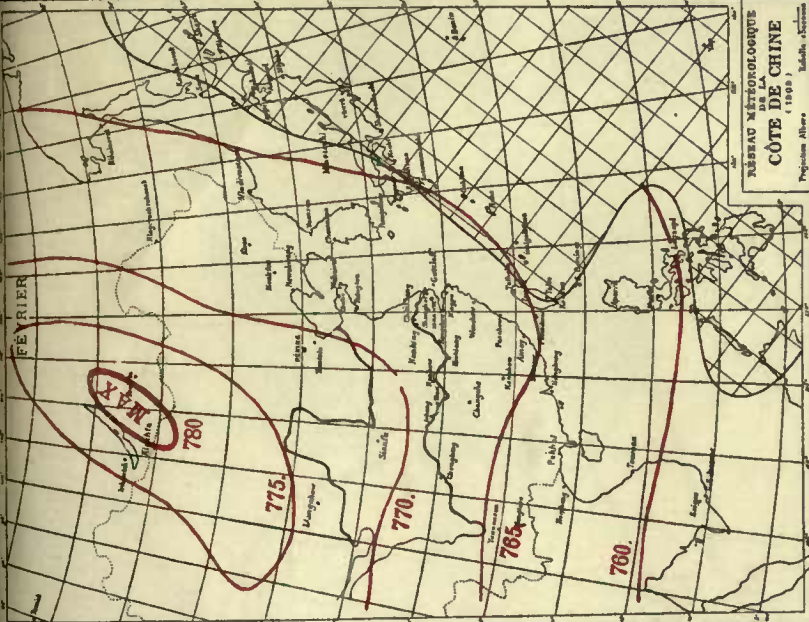
The typhoon is the enemy of the sailor, who will find in these twelve charts the territory exposed to the occupation of the adverse host and the extension of its front, as the year proceeds. Thus the aspect of the typhoon season is made clear in a striking way: July is already thick, August shows an increasing danger, September is the black period and October is nearly equal to August: then the map clears up and the enemy retreats for winter into the depths of the Pacific.

To help the reading of these maps, we append here, for each month, the total number of the typhoons for the 26 years, the number of instances for the same month (mean number) per year, and the dimensions of the sides of the corresponding little squares in the map, measured in millimeters.

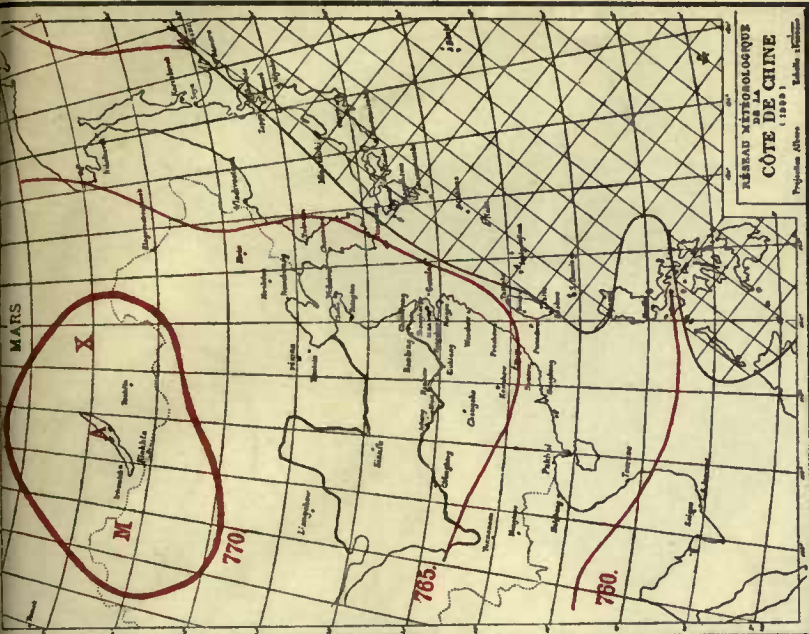
Month.	Total N.	N. per year	Square. mm
January	31	1,2	3,8
February	17	0,7	4,4
March	18	0,7	4,4
April	14	0,5	4,5
May	33	1,3	3,7
June	34	1,3	3,7
July	89	3,4	1,3
August	92	3,5	1,2
September	110	4,2	0,4
October	95	3,7	1,1
November	52	2,0	2,9
December	34	1,3	3,7



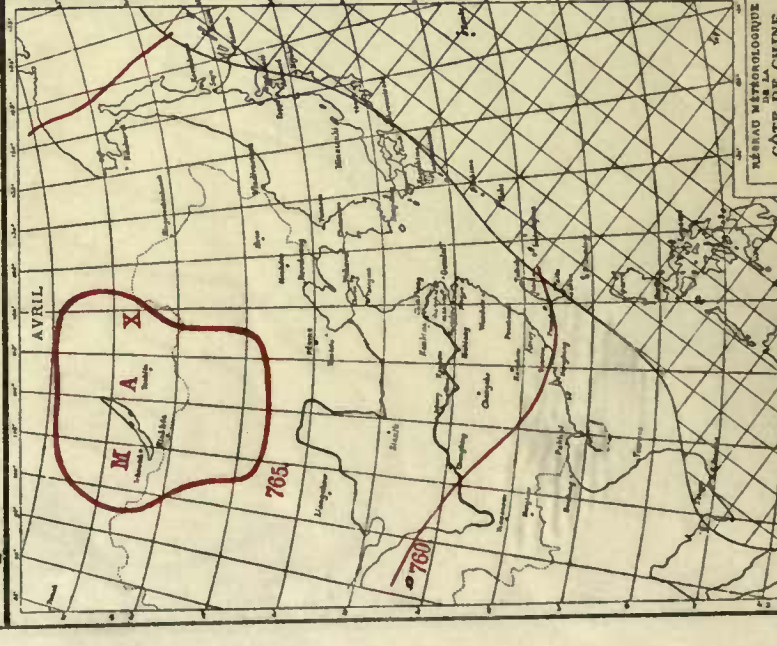
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CÔTE DE CHINE
(1900)
Projections: Hesse, Kalkreuth



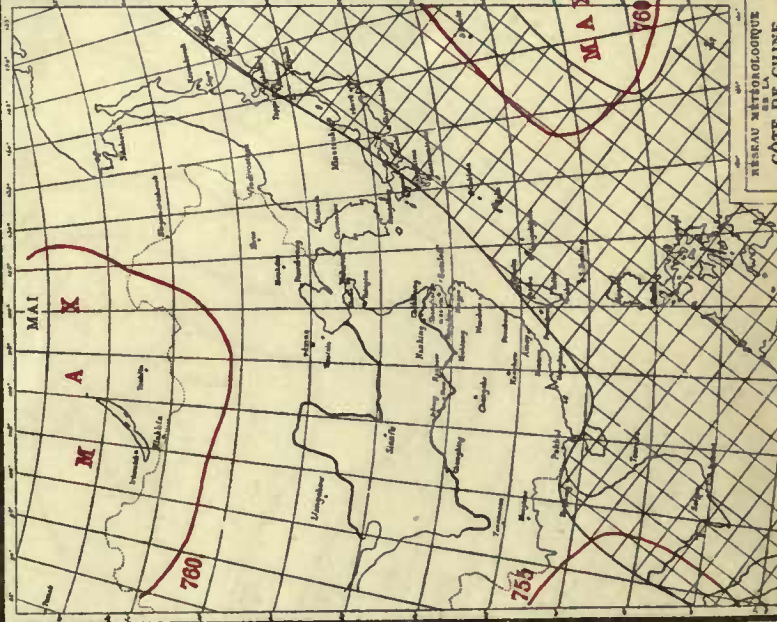
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DE LA
CÔTE DE CHINE
(1900)
Projections: Hesse, Kalkreuth



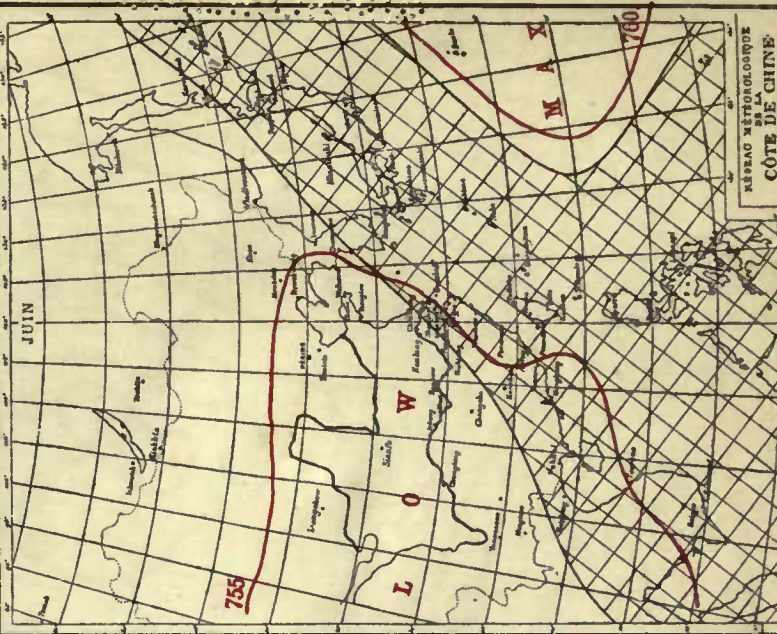
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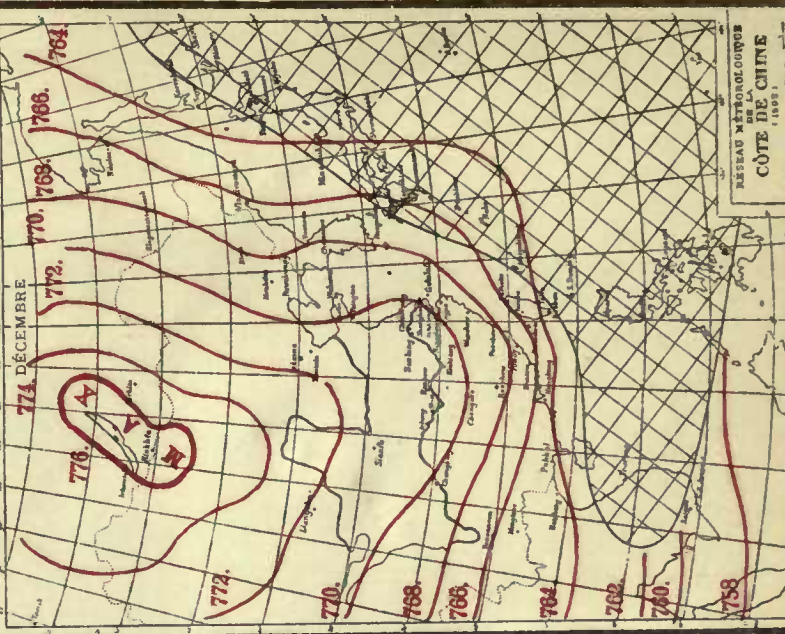
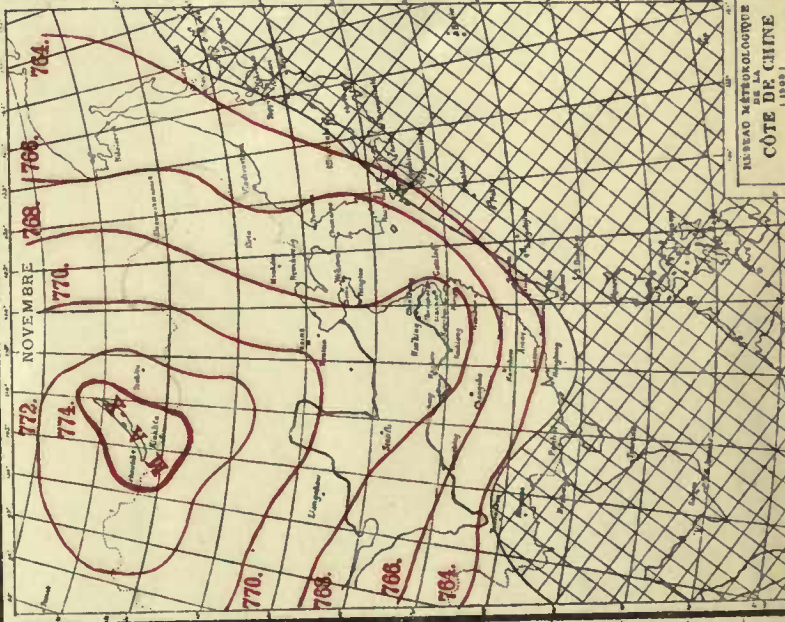
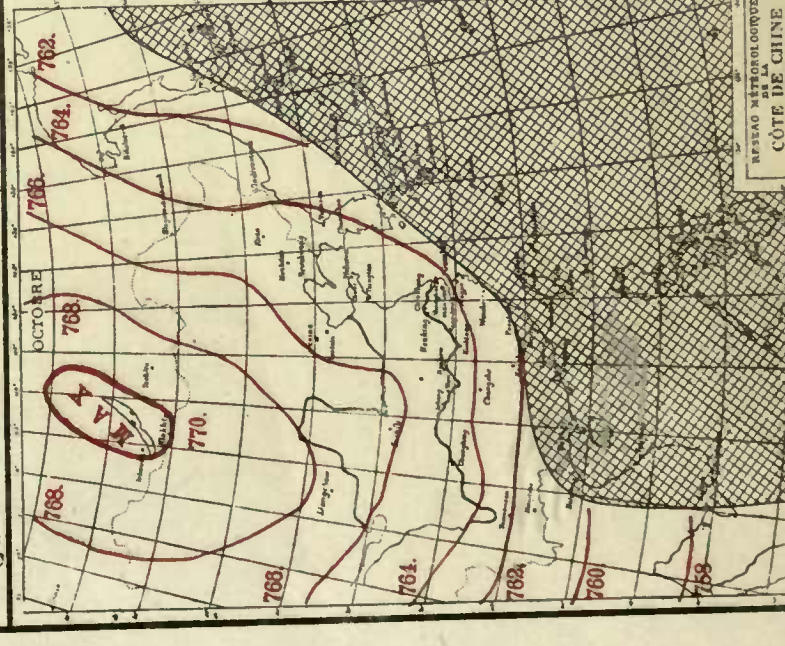
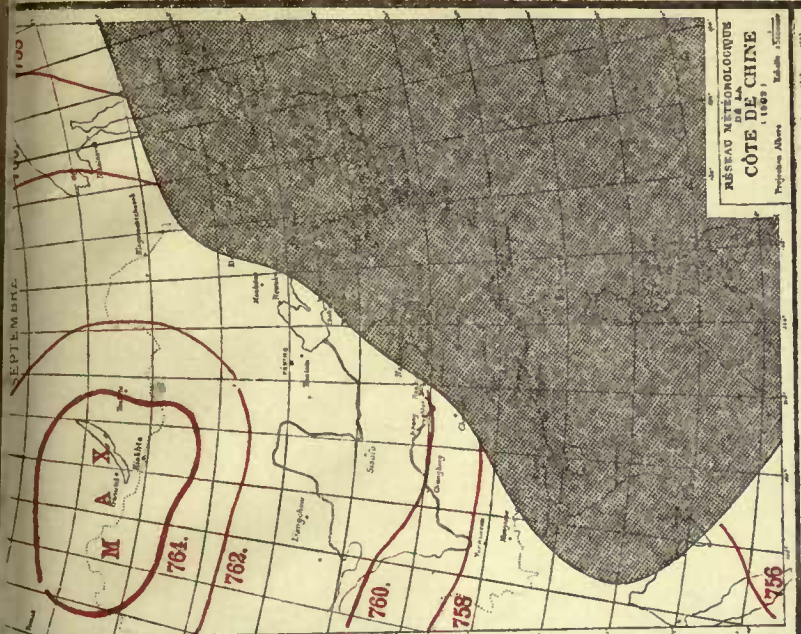
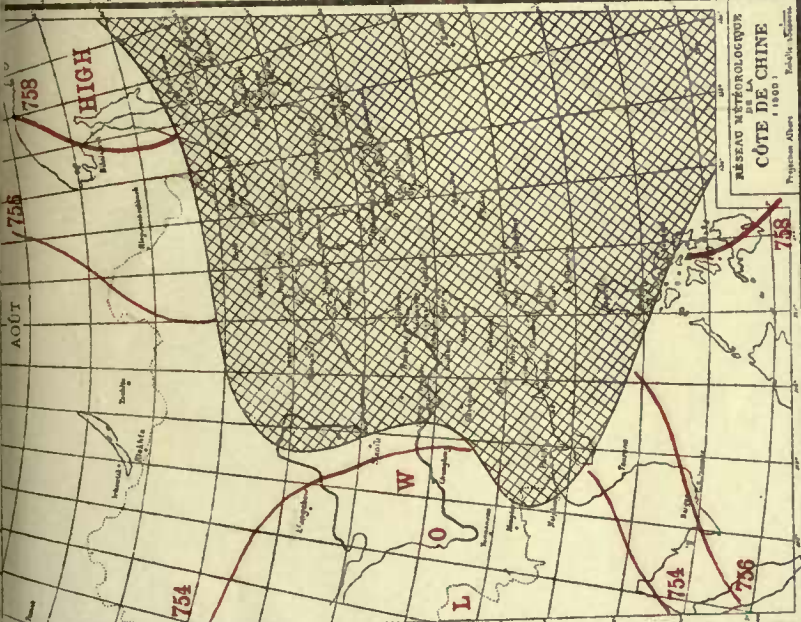
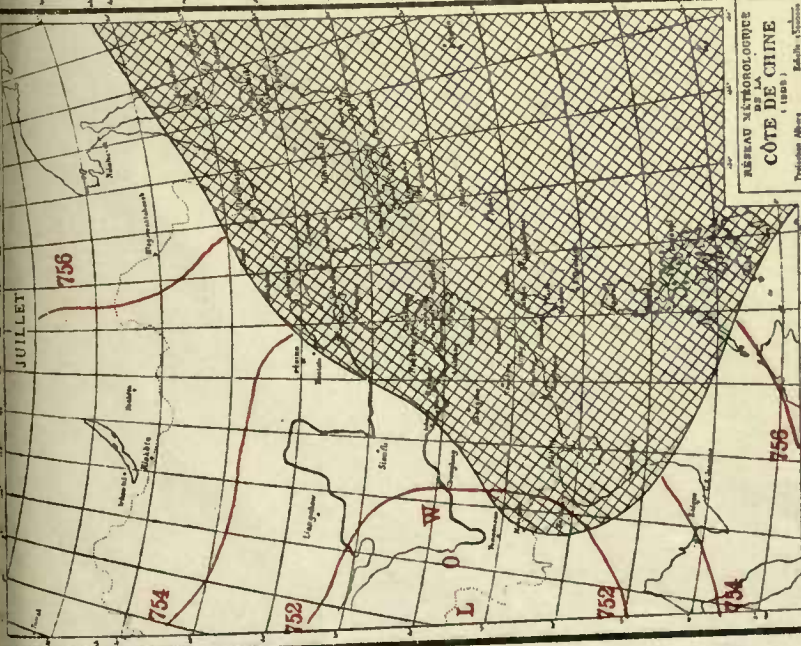
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